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Plant Breeding Abstracts.

Vol. II, No. 1.

Part I. British Empire

GENETICS 575

1. **Stadler, L. J.** 575.243:537.531

The experimental modification of heredity in crop plants. II. Induced mutation.

Sci. Agric. 1931 : 11 : 645-61.

The word mutation is used to indicate a gene change as opposed to a sudden change brought about by irregularities of whole chromosomes or parts of chromosomes.

The majority of mutants resulting from irradiation in maize are chlorophyll deficiencies, most of which are not viable. These characters have been very much used in chromosome mapping and extending the knowledge of the linkage groups.

The mutation rate has been worked out in barley. Various different types of ray have been used and for a given radiation applied to seeds of a given physiological state the mutation rate proved to be proportional to the intensity. Mutability and tolerance vary very much with the condition of the plant, dormant seeds being much less sensitive than germinating ones and so on. Mutability seemed to be almost unaffected by temperature, tolerance was somewhat greater at low temperatures.

The effect of polyploidy in reducing the frequency of observed mutation is pointed out and illustrated by wheat and oats. The possibility of adding desirable characters such as disease resistance, dependent on single recessive genes, by means of irradiation is discussed. It is also pointed out that certain deficiencies which in diploids result in lethality of the gametophyte, in polyploids have a greater chance of perpetuation. This applies less to gene than to chromosomal deficiency or duplication.

Attention is called to the absence of dominant mutants and to the fact that this is also true of the spontaneous mutations known which involve the same genes. It is suggested that irradiation increases only one type amongst many different types of mutation. Indeed, one mutating gene has been observed whose mutation rate was not affected by irradiation and it is realized that the identity of natural and induced mutation in all but speed has yet to be proved.

CYTOLOGY 576.3

2. **Thompson, W. P.** 576.312.38:633.11:575.127

576.312.38:633.11 *Aegilops*:575.127

576.312.38:633.14:575.127

Chromosome homologies in wheat, rye and *Aegilops*.

Canad. J. Res. 1931 : 4 : 624-34.

The author reviews the data at present available on the subject and in the discussion points out the inconsistencies in the known facts, especially with regard to *Aegilops*, and the difficulties caused by a lack of knowledge of the probable influence of external conditions on chromosome pairing or of the differentiation of a chromosome set or its parts.

3. **Darlington, C. D.** 576.35:575.1

Cytological theory in relation to heredity.

Nature 1931 : 127 : no. 3210 : 709-12.

The importance of an accurate knowledge of the cytological processes at meiosis to the study of heredity is pointed out, especially is it necessary to know exactly wherein meiosis differs from mitosis. This seems to lie in the fact that the threads at early prophase in meiosis are single, probably due to a precocious onset of the prophase.

The hypotheses of crossing-over and ring formation are discussed.

PLANT DISEASES 632

4. **Dickinson, S.** 632.451.2:575.114
Experiments on the physiology and genetics of the smut fungi. Cultural characters. Part II. The effect of certain external conditions on their segregation.
Proc. Roy. Soc. 1931 : B 108 : 395-423.

Observations were made on the segregation of a number of characters ; some segregated at the first and others at the second nuclear division of the promycelium. Characters which segregated at different divisions were presumed to be independent. Segregation also occurred at the third nuclear division. This is partially influenced by the external medium.

The mode of segregation of different characters varied but that of the more regular ones is interpreted on the Mendelian principles for haploid organisms, some characters being regarded as dependent on one, others on two or more factors, and certain linkages are indicated. Seven pairs of independent characters were demonstrated.

5. **Biffen, R. H.** 632.452:633.1
The cereal rusts and their control.
Trans. Brit. Mycol. Soc. 1931 : 16 : 19-37.

The question of physiological specialization is discussed from the historical point of view, together with the hybridization, the spread and control of the fungus, the inheritance of resistance and the breeding of resistant varieties.

ECONOMIC PLANTS 633

6. **Robb, W.** 633:575(41)
Review of work in progress at the Scottish Plant Breeding Station.
N. Brit. Agric. 1931 : June.

The objects and aims of the station are set out briefly, together with the methods of breeding. A new oat "Elder," resistant to lodging, is described ; the variety gave good yields of grain on fertile soil.

Other promising new strains are under test, including an early white-grained strain derived from Orion.

Among other things a study is being made of the effect of inbreeding on the potato. The fifth generation proves to be much more self-fertile than the earlier ones but homozygosity has not been attained in all characters.

The inheritance of various characters in swedes is also being studied extensively.

7. **Frankel, O. H.** 633.11-1.557(93.1)
Analytical yield investigations of New Zealand Wheat : 1.
1st Ann. Rep. Wheat Res. Inst. N. Z. 1930 : 42-59.

The Wheat Research Institute of New Zealand is faced with the problem of producing high quality wheats with increased yield.

The merits and demerits of the most prevalent varieties of the present day are discussed. It seems probable that two somewhat different types will have to be bred for the two different types of country.

To know what characters play the greatest part in determining yield is of first importance, both in choosing the parents and selecting the hybrid populations. Tests to investigate this were set up and indicated that certain of the high-yielding varieties were characterized by superior ear development and others by a high number of mature ears. Number and size of grains are also factors which influence yield. The conclusion is that for the conditions under examination the most important factor is the capacity to bring to maturity a large number of ears, followed by the size of the ears, then size of grain.

Response to wide spacings was taken as in a certain measure indicating adaptability; some varieties responded more than others. Some varieties on the other hand shewed a minimum change in grain size with differences in spacing, which is an advantage. The variety Yeoman II shewed a greater increase in number of grains per ear under conditions of wide spacing, a character shared to some extent by the wheats characteristic of the more fertile districts of New Zealand.

8. **Churchward, J. G.** 633.11:2.451.3-1.521.6:575.1

Studies in the inheritance of resistance to bunt in a cross between Florence x Hard Federation wheats.

J. Roy. Soc. N.S.W. 1931 : 64 : 298-319.

The F_2 contained 115 bunted plants and 139 bunt-free, some of which, as was shewn in F_3 , had merely escaped infection. The F_3 shewed a complete range from immunity to susceptibility. Plants described as "grass tufts" occurred in a ratio of 3:13 in F_2 , indicating the presence of an inhibiting factor. The inheritance of bunt and tip-beards is explained on the basis of a single independent factor for each.

9. **Callaghan, A. R.** 633.13:581.145.1

A study of anthesis in cultivated oats.

Agric. Gaz. N.S.W. 1931 : 42 : 311-21.

The process of anthesis in oats is described in detail with special attention to the behaviour under Australian conditions in comparison with the results obtained by continental workers.

10. **Gurney, H. C.** 633.15:575.116.1.061.6

The inheritance and linkage relations of xantha seedlings in maize.

Aust. J. Expt. Biol. and Med. Sci. 1930 : 7 : 215-21.

Two distinct factors for the "xantha" chlorophyll deficiency were present in the parental material. One of these is shewn to be linked with R, one of the factors for endosperm colour. The crossing over percentage varied somewhat in the different crosses.

11. **Mahta, D. N., and Dave, B. B.** 633.18:575.1(54.3)

Rice Breeding in the Central Provinces.

Ind. J. Agric. Sci. 1931 : 1 : 351-71.

The more economically important varieties of rice grown in the Central Provinces are described and illustrated and a scheme for classification is given. By means of hybridization, strains have been selected combining the desirable economic properties with dark purple leaf-sheath and auricles distinguishing them, at an early stage, from the wild rices.

A closer analysis of the inheritance of the various characters involved in these crosses will be given in another paper.

Work is needed on the production of a high-yielding rice with strong straw.

12. **M'Master Davey, V.** 633.42:575.11.061.6

Colour inheritance in swedes and turnips and its bearing on the identification of commercial stocks.

Scot. J. Agric. 1931 : 14 : 303-16.

It is shewn that white flesh being dominant to yellow, pure yellow strains are more easily established than pure white strains. Hybrids from rape pollen cannot be easily detected in white swede populations and are very undesirable. Out-pollination from turnip is also possible but is easily detected.

Two factors for white flesh exist in swedes; the consequent breeding behaviour is indicated.

Flower colour is governed by the same factors or by factors very closely linked. This affords a valuable means of detecting hybrids resulting from pollination with white-fleshed forms. Only one of these two factors is present in turnips.

The red skin colour in turnips is dependent upon one factor, green upon another independent factor, the two together giving "purple." The breeding behaviour consequent upon this is again described. These factors are independent of the flesh colour factor. Various distribution factors also seem to be involved.

Here again the case in the swedes is much more complicated owing to the duplication of the characters.

No difference in dry matter content could be observed between red and white skinned turnips segregating in the F_2 of a cross.

13. **Hutchinson, J. B.**

633.51:575.11.061.6:581.46

The genetics of cotton. Part IV. The inheritance of corolla colour and petal size in Asiatic cottons.

J. Genet. 1931 : 24 : 325-53.

This paper is a record of the most detailed investigation that has as yet appeared on the corolla of the Asiatic forms of *Gossypium*, several questions in connection with which previous work had left unanswered. The number of types used is large and includes the major recognized groups.

The petal colour in the Asiatic cottons is yellow, pale yellow or white. Ten standard grades, ranging from white to full yellow are determined and the offspring of numerous crosses as well as backcrosses are classified by this scale. By the critical cross (Yellow x Pale) x White it is shown that Yellow, Pale and White form a multiple allelomorph series. Of incidental interest is the explanation of the significant excess of whites which sometimes occurs, as due to a correlation between the gene *y* and longer viability of the sporophyte as well as greater rate of pollen tube growth in the gametophyte.

The close (complete) correlation between petal colour and petal length which had previously been noted for the Indian forms of the Asiatic group, is checked by a series of crosses including extra-Indian forms. Yellow flowered plants are found to have longer petals than pale flowered and these, again, longer petals than white flowered. Modifying factors however occur, which affect both petal length and grade of colour, and it is possible to secure whites with fairly long petals and also short yellows but these latter with a lower colour grade than that found in the long yellows.

The association between the characters lint length, lint index (weight of fibre in mg. per 100 seeds), lint per cent (weight of lint in g. per 100 g. seed) and seed weight on the one hand and corolla colour on the other is briefly studied. It is concluded that there is a slight, but real, difference in lint length between yellows and whites, the former having longer lint, and that both the main corolla colour factor and the minor modifiers for corolla colour and petal length increase lint length and decrease lint density, or hair weight.

14. **C. A. B.**

633.61:575(96.9)

Scientific work in the Hawaiian Cane Fields.

Int. Sug. J. 1931 : 33 : 321-25.

An account of the work described in the report of the Hawaiian Sugar Planters' Association. Enormous numbers of seedlings of four lines of descent, Kassoer, Uba, Indian thin canes and ordinary tropical canes, are under test.

Great emphasis is now being laid on the importation of fuzz from other countries, enabling hybrids to be raised from hardy Indian canes, the new species *S. robustum* from New Guinea and the Australian canes.

P.O.J. 2878 proved the most outstanding of the foreign canes tested.

15. **Coleman, L. C.** 633.73:575(54.8)
 The improvement of coffee in the Dutch East Indies.
 Bull. Dept. Agric. Mysore, 1931 : (Gen. Ser.) No. 15 : 19 pp.
 An account of coffee growing in Java. Extensive selection work on *Coffea robusta* is being carried out. Grafting is much practised and certain *robusta* selections are now used as stock. Mixed populations are advised to overcome the effects of partial self-sterility. Crosses are being made of *arabica* with *robusta* and *congensis* and valuable results are expected, especially with *congensis* as regards leaf disease. *Arabica* selections are also in progress. The methods of general cultivation and preparation of the coffee for the market are described.
16. **Patwardhan, G. B.** 633.853.55:575.11
 A preliminary note on inheritance in castors.
 J. Ind. Bot. Soc. 1931 : 10 : 100-09.
 Spines shewed intermediate dominance in F_1 . Bloom was also intermediate-dominant, "triple" bloom being dominant to "double" and "single" to no bloom. Green was dominant to absence of green (pink) in the capsules in F_2 , although F_1 was coloured. Green stem acted as a simple recessive to various grades of colour.
17. **Moffett, A. A.** 634.1:576.356.5
 A preliminary account of chromosome behaviour in the *Pomoideae*.
 J. Pom. Hort. Sci. 1931 : 9 : 100-10.
 To test the hypothesis put forward in earlier papers (see Plant Breeding Abstracts, Vol. I, Abst. nos. 127, 465) the chromosome numbers of a number of different species of the *Pomoideae* were examined. The basic number proved, as expected, to be 17, aneuploid forms occurring extremely rarely, only in the progeny of triploids.
 All the diploid forms shew secondary chromosome pairing at metaphase I, similar to that found in *Pyrus*, groups of four or six chromosomes becoming associated after prophase. Never less than seven of these groups were observed and never more than six chromosomes entered a group. In triploids the proportion of multivalents was higher than in diploids or tetraploids. In progenies of crosses of triploids x diploids, the most frequent number was 41, which is the sum of the primary haploid number 7 and the secondary diploid number 34. This therefore supports the assumption of the derived nature of the basic number 17 and it is suggested that the morphological characters of the *Pomoideae* are a result of their peculiar chromosome constitution.
18. **Moffett, A. A.** 634.1:576.356.5
 The chromosome constitution of the *Pomoideae*.
 Proc. Roy. Soc. 1931 : B. 108 : 423-46.
 The somatic and haploid chromosome numbers for a great number of species of the *Pomoideae* are given. All species had simple multiples of seventeen.
 The chromosome behaviour in all the diploid forms is very similar and usually regular, except for a regular tendency for the bivalents to associate in groups of four and six. This association is never such that the total number of groups is less than seven or the number in a group greater than six.
 In some of the triploid species the pairing is almost complete, triploid association being common and also a certain amount of autosyndesis within each of the three sets of seventeen, leading to higher combinations.
 In other triploid species as many as fourteen univalents may be present. In these the paired chromosomes are associated into groups of four or six rather than three; multivalent associations also occur. This is evidently because these species are not autopolyploids like the former triploid group but arise as hybrids by the union of a tetraploid with a diploid.
 In the tetraploid species the most frequent multivalent associations are quadrivalents but these apparently associate in higher groups as in the diploids, groups of 6 and also 8 and possibly 12 occur.

In the progeny of triploids x diploids there was a preponderance of individuals with 41 chromosomes, which is the sum of the presumed primary haploid number 7 and the secondary diploid number 34, apparently resulting from the greater viability of the $17 + 7$ gametes in the triploids. All these facts clearly lend support to the previous assumption that the chromosome number 17 characteristic of the *Pomoideae* is a secondary number derived from the true basic number 7, by 3 of these being present in the triploid and the remaining 4 in the diploid state. The establishment of such a secondary basic type is regarded as a definite step in evolution, being accompanied as it is by a whole series of features characteristic for the group, including the pomoid fruit.

19. Crane, M. B., and Lawrence, W. J. C.

634.711:575.1:577.81

634.711:575.1.061.5

634.711:575.1.061.6

Inheritance of sex, colour and hairiness in the raspberry, *Rubus idaeus* L.

J. Genet. 1931 : 24 : 243-55.

Four sex forms were found in *Rubus idaeus*, male (M), female (F), hermaphrodite (FM) and neuter (mf) which segregated in ratios indicating a two factor inheritance. There was a correlation between M and obtuse leaves.

Two factors determine colour, T gives red fruits and tinged spines and P is an intensifying factor. One factor, H gives hairy growth. Homozygous HA forms were not found and their association with a lethal factor is suggested.

20. Mahta, D. N., and Dave, B. B.

635.659

Studies in *Cajanus indicus*.

Mem. Dept. Agric. Ind. Bot. 1931 : 19 : 1-25.

Includes morphological descriptions of the various types in cultivation, the duration of the flowering period, methods of pollination, data on the extent of natural crossing and a classification in which two forms are distinguished, one short and ripening early, the other tall, ripening late.

Part II. Foreign

GENETICS 575

21. Laibach, F. 575.182:633.52
Ueber Störungen in den physiologischen Beziehungen zwischen Mutter und Embryo bei Bastardierung.
(Disturbances in the physiological relations between female and embryo on hybridization.)
Z. induct. Abstamm.- u. VererbLehre. 1931 : 59 : 102-25.

The hybrid *Linum austriacum* x *L. perenne* or the reciprocal hybrid when selfed or crossed with *L. austriacum* pollen gave a good seed set and embryo development, but when crossed with *L. perenne* pollen the seed set is less. The plant produced in the first case resembled *L. austriacum* and in the second case *L. perenne* and it seems that the hybrid serves as a good parent for the former type but not for the latter type. Further, the backcrosses, using the hybrid as pollen parent were more successful on to *L. perenne* than *L. austriacum*. An examination of the relative sizes of the embryo and seed in the above crosses suggests that herein lies the explanation and that better success is obtained when the seed is rather too large for the embryo than when it is too small, the size of the seed being almost entirely influenced by the female parent. That the embryos were themselves sound was shewn by artificially removing them from the seed, in which case they could be made to grow into healthy plants.

Very similar results were obtained in F_2 crosses; the products of the backcrosses of the F_1 with the parental species behaved almost exactly as the parental species themselves; there would be therefore no difficulty in the way of using these species in breeding for the combination of characters from both.

Comparison of these results with those from crossing other species of *Linum* shews that the seed size is not the only factor but that the degree of relationship between the two species plays an even more important part in the successful development of the embryo.

22. Gagnepain, F. 575.24
À propos de mutations : une hypothèse.
(Concerning mutation : an hypothesis.)
Bull. Soc. Bot. Fr. 1931 : 78 : 95-97.

It is pointed out that cultivation has tended towards doubling and this is invariably accompanied by reduced sexuality, culminating in pollen sterility. The author suggests that by working in the opposite direction—of reduced vigour—the sexuality would be increased and mutations more frequent.

23. Nilsson, N. H. 575.243
Sind die induzierten Mutanten nur selektive Erscheinungen ?
(Are induced mutations only selection phenomena ?)
Hereditas 1931 : 15 : 320-28.

The author shews that one of the mutant types "induced" by particular treatment is more viable under the conditions of treatment than is the normal. He explains the increase in proportion of these types therefore not to their increased rate of production but to the decreased viability of the normal. Similarly it is shewn that in certain *Oenotheras* the proportion of mutants increases with the age of the seed, when this is accompanied by a fall in germination percentage.

24. **Lawrence, W. J. C.** 576.356.5:581.162.5
Incompatibility in polyploids.
Genetica 1930 : 12 : 269-96.

The behaviour of diploids and polyploids in relation to incompatibility is discussed and the theory advanced by Sirks in explanation of the results obtained by him with *Verbascum phoeniceum* is modified by assuming *Verbascum* to be allotetraploid. With this new interpretation the facts are found to be in better agreement. A similar explanation is advanced for the behaviour in *Cardamine pratensis*.

By the polyploid theory "like factors in pollen and style positively inhibit and unlike factors positively promote pollen tube growth, but the potencies of these two opposite reactions are unequal."

25. **Honing, J. A.** 576.36:581.142.035:633.71
Nucleus and plasma in the heredity of the need of light for germination in *Nicotiana* seeds.
Genetica 1930 : 12 : 441-68.

This is a continuation of previous work on the influence of light, temperature and drying over lime on the germination of *Nicotiana* seed. To these stimuli the response shown by different races is very markedly diverse. Some races require light, others are indifferent; some respond to changes of temperature, others do not. The contradictory results obtained by different workers is explained by the difference of races with which they worked. By a series of crosses and backcrosses the heritable nature of the dependence on light is traced. Occasionally need of light is a simple dominant to indifference but this simplicity does not always occur. Reciprocal crosses give F_1 embryos which show a maternal preponderance, present, but strongly reduced, in the F_2 . Superimposed on the nuclear factorial difference there appears to be a gradual change in the character of the plasma under nuclear influence after fertilization. Further, the presence of differences in valency or minor modifying factors is used to explain some of the differences observed.

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26. **Sessous, G.** 633:575
Landwirtschaft und Pflanzenzüchtung.
(Agriculture and plant breeding.)
Fortschr. Landw. 1931 : 6 : 385-88.

The history of plant breeding in Germany is briefly outlined, stress being laid on the loss of quality by the substitution of the land races by higher yielding exotic types.

The various influences which the development of plant breeding has had on other branches of agricultural science are discussed, followed by a discussion of the requirements of the future.

27. **Feichtinger, E. K.** 633:575(43.6)
Compte-rendu sur l'état actuel de l'amélioration des plantes de grande culture en Autriche.
(Report on the present state of the improvement of crop plants in Austria.)
Bull. Assoc. Int. Sélect. Plantes 1931 : 4 : 135-45.

The different climatic regions of Austria are described, with indications of their chief crops. There follows a list of plant breeding stations, with brief descriptions of the chief varieties which each has produced.

28. **Baur, E.** 633:575(47 + 43)
(The problems of plant and animal breeding in Russia and Germany.)
Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 3-7.

The author calls attention to the present agricultural crisis in Germany; it is impossible to abandon agriculture and depend on trade, as has been done in England, because of the lack of colonies to supply the products. To do this would throw Germany, the author states, into

dependence on England. Every effort is therefore being made to put agriculture on a firm footing.

The second difference between the two countries is that the old local varieties which have almost entirely disappeared in Germany, in Russia remain, in most parts of the country untouched by the breeder. In Germany the yield has been in this way increased by at least 30 per cent but it seems that the limit of improvement possible by the ordinary methods of selection and recombination have almost been reached. The quality has been very little improved and it is evidently necessary to discover new ways to do this.

One of these seems to lie in making use of material, and not only races but species, from other regions, notably Asia.

The second way is the creation of polyploid races by crossing species with different chromosome numbers or by the action of various external agents and the third is the artificial production of mutations by the use of similar agents.

Special problems can certainly be solved by the old methods, e.g., the creation of a wheat variety which will make the maximum use of the water supply, for cultivation under irrigation, or the production of a more profitable plant to replace part of the area under such crops as potatoes and sugar beet.

The breeding of fruit trees and vines is of great importance in Germany, in the latter case with the object of producing disease resistant hybrids.

In Russia, with its wealth of indigenous forms, the most immediate practical results should come from ordinary selection and breeding.

The centralization in Russia is another advantage.

29. **Pissarev, V. E.**

633:575.14

(The inbreeding method in the breeding of cultivated plants.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 9-16.

The method of inbreeding for cross-fertilized plants is becoming more and more important.

If a number of plants are chosen from a cross-fertilized population and subjected to self-pollination the resulting families may be regarded as F_2 and the ordinary methods of selection can be applied from here on, under conditions of artificial self-pollination.

Small amounts of self-fertilized seed have been obtained in certain strains of many plants which have been regarded as self-sterile. Individual plants vary very much in the effect which self-fertilization produces.

The plants which under conditions of inbreeding appear the best, are not necessarily the ones which will give the best results finally, after the inbred lines have been crossed to restore vigour.

The best combinations are usually decided by Johannes Schmidt's method of diallel crosses. Inbreeding is the only way of removing lethal genes and the like from the population, it can be used for combining the qualities of two varieties by hybridization and, most important of all, is the only way of isolating forms with characters depending on recessive factors, which is the case with the majority of characters of practical importance. A number of cases where this has been done are cited.

Inbreeding methods have also been used with success in plants in which cross-fertilization occurs only occasionally, and for selecting suitable forms of exotics in the process of acclimatization. Individual plants of Assam tea as cold-resistant as Chinese types have been isolated in this way.

30. **Hess, G.**

633:578.08

Die Stereophotographie, ein Hilfsmittel für den pflanzenbaulichen Versuchsansteller und den Pflanzenzüchter.

(Stereophotography in the aid of the agricultural experimenter and plant breeder.)

Fortschr. Landw. 1930 : 5 : 166-

Differences in habit, etc., can be very much more clearly illustrated by means of stereoscopic photographs than ordinary photographs and its use is strongly recommended for preserving records of differences which are seen during development, without the necessity of destroying the plant.

31. **Ducomet, V.** 633.00.14-1.421
Les essais comparatifs de rendement. II. Parcelles juxtaposées ou sentiers de séparation. Forme, disposition, grandeur et nombre des parcelles. Du semis et de la récolte.
(Comparative yield tests. II. Juxtaposed plots or dividing paths. Form, arrangement, size and number of plots. Sowing and harvesting.)
Bull. Assoc. Int. Sélect. Plantes 1931 : 4 : 147-54.

The elimination of vicinism, the form and arrangement of plots, their size and number are discussed briefly with reference to cereals, beet, potatoes and forage plants.

32. **Kostecki, E.** 633.00.14-1.421
Les essais comparatifs, point de départ et contrôle de la sélection.
(Comparative tests, starting point and checking of breeding.)
Bull. Assoc. Int. Sélect. Plantes 1931 : 4 : 155-60.

Remarks on various precautions to be taken on setting up comparative tests.

33. **Cross, W. E.** 633.00.15(8)
La Estación Experimental Agrícola de Tucumán y su obra.
(The Agricultural Experiment Station at Tucumán and its work.)
Rev. Ind. Agric. Tucumán 1931 : 21 : 67-71.

A brief account of the objects and work of the Station, which includes the production by hybridization of new varieties of sugarcane, cotton, tomatoes, tobacco and other plants.

34. **Miège, E.** 633.1(64)
L'effort marocain pour l'amélioration des céréales.
(The effort in Morocco to improve the cereals.)
Agric. Prat. Pays Chauds 1930 : N.S. No. 5 : 342-52.

A description of the new administration.

35. **Sessous, G.** 633.1:575(43)
Die deutsche Getreidezüchtung.
(The German cereal breeding.)
Der Züchter 1931 : 3 : 181-84.

A very general review of the subject.

36. **Nilsson-Ehle, H.** 633.1-1.8
Einige Versuche über das Verhalten und die Rentabilität verschiedener Varietäten bei erhöhter Stickstoffdüngung.
(Some experiments on the behaviour of different varieties to high nitrogen manuring and the economic return.)
Z. Pflanzenernähr. 1931 : 10 : 169-81.

One of the important problems before the cereal breeder to-day is to produce varieties which will yield well under normal conditions of cultivation and at the same time be adapted to the high nitrogen conditions prevalent in conditions of intensive farming.

Combined variety and manurial trials were made with cereal varieties, all of which normally stand quite well but some of which had straw definitely stronger than the others.

The first 100 kg. per ha. manure over normal gave the same yield increase in all varieties but the second 100 kg. produced a considerably greater increase in the strong-strawed varieties.

In a similar way the highest increases were obtained in spring wheats only when the variety was also sufficiently early ripening.

With barley, high doses of nitrogen could be given without undue increase of nitrogen content of the grain in the case of strong-strawed types.

It is also shown that the absolute yield increase from a given quantity of manure is greater for high-yielding than for lower-yielding types; differences in yielding capacity can often only be observed under conditions of high manuring.

37. **Tu, C.** 633.1-2.48:576.16
 Physiologic specialization in *Fusarium* spp. causing headblight of small grains.
 Tech. Bull. Minn. Agric. Expt. Sta. 1930 : 74 : 27 pp.
 Head-inoculations were made on various varieties of wheat and barley with various cultures of *F. culmorum* (*Gibberella saubinetii*) and *F. graminearum*. Three forms of each were distinguished differing in virulence. In *F. avenaceum* two forms were distinguished. *F. solani* and *F. nivale* were also tested.
 The five species were shewn to differ in pathogenicity and to differ in temperature requirements and capacity for alcoholic fermentation.
 A colour mutation was observed in one culture, being later shewn to be different in many morphological and cultural features and was characterized by reduced pathogenicity.
38. **Shekhurdin, A. P.** 633.11:575(47)
 633.11:575.127.2
 (The lines on which the breeding of summer wheat is conducted at the Saratov Experiment Station and its results.)
 Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 411-19.
 The old methods of "analytical selection" used up to 1918 and its results are only briefly outlined. The great success attained by this method was in creating varieties with enhanced yield and drought resistance, the difference in favourable years being 16.6 per cent but in dry years as much as 37.7 per cent.
 From the cross *Triticum durum* v. *hordeiforme* x *T. vulgare* v. *lutescens* four types were extracted, distinguished by particularly high yield, one of them giving 8.2 per cent more than pure line No. 62 which is one of the best of the selected strains. They were also superior to 62 in absolute grain weight and baking quality. They also have the advantage of being tough-eared types.
 Crosses were also made between varieties of *T. vulgare* of different geographical origins. Two constant lines were obtained from this cross, one of which had vitreous and both well-filled grains. The former, even after repeated backcrossing with *T. vulgare*, did not yield as well as pure line 62, although it was distinctly better than the local varieties. The second of the two gave yields equal to 62 or better; this variety had grain of intermediate vitreousness.
 In grain weight they exceeded the local variety. The milling quality was somewhat low.
 From another cross a type ripening five to six days earlier than 62 was extracted. Its yield was intermediate between that of 62 and the local variety. It is expected that a continuation of the work will bring the yield up to that of 62.
39. **Caty, R.** 633.11:575(61.1)
 L'amélioration des blés en Tunisie.
 (Wheat breeding in Tunisia.)
 Agron. Col. 1930 : 19 : 165-69 and 20 : 8-19.
 A brief description of the work of introduction, selection and hybridization by which the yield and area have been increased and the cultivation of *vulgare* wheats of superior quality made possible. The methods used are described in some detail.
40. **Stewart, G., and Bischoff, R. K.** 633.11:575.11
 Correlated inheritance in a cross (Sevier x Dicklow) x Dicklow wheats.
 J. Agric. Res. 1931 : 42 : 775-90.
 Culm length, stature, number of culms and awns, density and glume colour were studied in this cross. The F_3 progeny exceeded the range of both parents but no segregation could be distinguished for culm length. Dwarfs occurred in F_2 and F_3 in numbers suggesting two factors, one dominant for dwarfness and the other an inhibitor. Number of culms was the same for both parents and progeny. One factor was found for awns, the ratio being 1 : 2 : 1 and one main factor for density with probably at least one modifying factor increasing the laxness and one factor for glume colour.
 Significant correlations were found between awn length and spike density for the fully awned plants and between spike density in F_2 and F_3 . Soil heterogeneity and competition between varieties were found to have a considerable effect on variation.

41. **Oehler, E.** 633.11:575.127:633.14
 Untersuchungen über Ansatzverhältnisse, Morphologie und Fertilität bei Weizen-Roggenbastarden.
 (Researches on the grain-setting, morphology and fertility in wheat-rye hybrids.)
 Z. Züchtung 1931 : A. 16 : 357-93.

Varieties of *Secale cereale* L. were used as the pollen plant and chiefly varieties of *Triticum vulgare* though some other varieties and species were tried. On the whole, more grain set among the early flowering *vulgare* varieties than among the late flowering.

Grain setting in the emmer group was apparently high but many of the grains were without embryos and all were shrivelled.

Crosses with *Tr. polonicum*, *Tr. dicoccum*, *Tr. monococcum* and *Tr. aegilopoides* were tried without success.

The morphological characters of the F_1 hybrids were carefully noted. The F_1 plants resemble wheat in culm thickness, colour of culm nodes, characters of the leaf sheath and auricles, shape and breadth of the ear internodes, ear density, number of flowers per spikelet and form and size of the empty glumes.

The rye characters straw-stiffness, hairiness of the stem below the ear and the direction of the awns were dominant. Ear length and breadth (in part), number of spikelets per ear, shape and form of lemmas and paleae, position of the attachment of the awns were intermediate. Certain other characters were more vigorous in the hybrids.

With regard to the fertility of the F_1 , unsuccessful attempts at self-pollination were made.

Artificial backcrosses were successful only with wheat and then only to a very slight extent, 0.3 per cent.

F_1 plants exposed to the possibility of natural crossing set about 0.08 per cent of grain.

The F_2 and F_3 plants were therefore all the result of backcrosses with wheat and there were not enough for a very accurate analysis.

About two thirds of the plants were stiff-strawed and all the F_2 of the cross *Tr. compactum* x *Secale* were strikingly short-stemmed. On the whole the characters of the F_2 were intermediate between those of F_1 and wheat.

F_2 and F_3 plants could be grouped into four classes with regard to sterility (1) fully sterile, (2) with a certain number of fertile egg-cells, (3) partly self-fertile (4) more or less completely self-fertile.

Backcrosses in F_3 with rye pollen were occasionally successful.

42. **Tschermak, E.** 633.11:575.127:633.14
 Weizen-Roggenbastarde und ihre züchterische Verwertung.
 (Wheat-rye hybrids and their value from the point of view of breeding.)
 Der Züchter 1931 : 3 : 244-48.

The true-breeding, constant intermediate hybrids of *Triticum* and *Aegilops* arising by chromosome addition are briefly described and the possibility suggested that in a similar way forms might arise in which the earliness, hardness and suitability for poor conditions of rye are combined with wheat characters.

The character of the wheat-rye hybrids is described. The F_1 plants are characterized by very luxuriant growth.

Backcrosses with wheat may give fertile forms, backcrosses with rye may also succeed. The wheat-like segregates are more fertile than the intermediates, which latter have imperfect pollen and shrunken grain.

The author envisages the possibility of the formation of haplo-diploid zygotes on backcrossing, and the production from this F_2 of di-haploid and di-diploid gametes; the constant intermediate hybrid described by Levitsky and Benetskaja is regarded as having arisen from one of the latter. Similarly by loss of one parental chromosome gamiture types resembling one of the parents in almost all characters have been produced. Certain isolated characters from the other parent may pass over into such forms and certain wheat types have been obtained which possess the winterhardiness and earliness of rye and good baking quality. It has yet to be seen whether they will grow on the poor rye soils.

43. **Kharitonov, P. A.** 633.11:575.127:633.14

(The breeding of rye-wheat hybrids.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 403-09.

A very brief résumé of the methods of dealing with the various generations is given.

The work having begun in 1918, there are several 1919 and 1920 families now included in the comparative tests of winter wheat varieties. In severe winters during which the winter wheat parent almost perished and the rye parent was badly damaged, certain of the hybrid families proved to be definitely resistant to cold and drought in nursery tests. In three consecutive years 76 per cent wintered better than the wheat parent, 60 per cent better than the most resistant wheat line obtainable and 36 per cent as well as rye.

Certain families were further characterized by the power of resuming growth rapidly and vigorously immediately the snow thaws in spring. Others grow slowly at the beginning of spring and rapidly later, quickly becoming equal with or better than the former type.

With regard to drought resistance the hybrids exceeded the same standard wheat as before by 16 per cent in the first and 68.1 per cent in the second drought period. The most resistant numbers came from a certain limited number of families.

The hybrids were in the majority of cases superior to the standard in 1000 corn weight, shewed a higher proportion of vitreous grains and certain families combined the qualities of well-filled, heavy and vitreous grain.

Amongst the hardy families retained for preliminary multiplication some were distinguished by high yield, others by ripening as early as or even earlier than rye or by high grain quality. All hybrids, with the exception of two numbers, out-yielded the standard by 20-60 per cent. Some families reacted very clearly to differences in soil fertility, others not at all.

The most favourable numbers were retained for preliminary variety tests, followed by full variety tests. Three outyielded the standard by 10 to 20 per cent. The hybrids were superior to the standard in size and absolute weight of grain, one had vitreous grain. Certain plants were only slightly attacked by *Fusarium nivale*. Satisfactory baking tests were given by one hybrid and others are now ready for testing in which the grain quality appears still better. Some hybrids combined a number of these various desirable characters.

44. **Konstantinov, P. N.** 633.11:575.127.2

(Contributions to the question of species crossing in summer wheat.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 177-86.

In crosses between *Triticum durum* and *T. vulgare* the F_1 was mostly intermediate between the parents and the majority of the plants were sterile. The percentage of success was in the neighbourhood of 37. *Vulgare* forms separated out more readily than *durum* forms and it was easier to obtain combinations of the desirable characters in the former.

Certain characters were transferred from the *durum* parent to the *vulgare*-like segregates, e.g., resistance to fungus diseases, grain quality, earliness. A number of new types and combinations also emerged.

When pollination was done with perfectly fresh pollen the results from reciprocal crosses were almost equal, when pollen was kept a short time before pollination the results were better with the *vulgare* pollen. The length of time between emasculation and pollination also seemed to influence the success and it was clear that the best results were only to be obtained with fresh pollen applied immediately after emasculation.

The average number of grains produced by the F_1 was 1.4 per plant, 0.94 for the *vulgare* x *durum* cross and 1.8 for the *durum* x *vulgare* cross. Of the 32 F_2 plants 24 per cent proved to be constant in F_3 . The number of grains per F_2 plant was 30.5 for *vulgare* x *durum* and 21.8 for *durum* x *vulgare*. The F_2 contained a large proportion of *vulgare* forms, more in the *durum* x *vulgare* cross than in the reciprocal.

Certain of the characters examined in F_2 gave approximations to a monohybrid ratio, others such as density, colour of grain, pubescence of chaff, seemed to depend on several factors. Here again the segregation was different in the reciprocal crosses.

The percentages of the different types appearing in F_3 are given. The great majority of these were *vulgares*, especially in the *vulgare* x *durum* cross. There were constant forms of *durum*,

vulgare and speltoid forms; one plant of *T. vulgare* var. *albidum* had very good grain and adherent glumes.

With *vulgare* as female the *durum* types were more fertile, in the reciprocal cross the conditions were reversed; intermediate forms were always less fertile.

Further varieties still appeared in F_1 , including an awnless *durum*. The hybrids are equal in yield to the standard varieties and surpass them in earliness and absolute weight.

Emphasis is laid on the necessity of making a large number of crosses of different and reciprocal combinations, and the extremely valuable practical results which may then be obtained. Many of these hybrids were perfectly fertile and combined the valuable characters of both parents, e.g., adherent glumes, disease resistance and good grain with *vulgare* characters.

45. Kagawa, F.

633.11Aegilops:575.127.2

Chromosome studies of a species cross in *Aegilops*.

Bull. Utsunomiya Agric. Coll. 1931: 1: 57-60.

Ae. cylindrica was crossed with *Ae. triuncialis*, both species having $n = 14$.

Two F_1 plants were obtained, being intermediate in most ear characters.

In metaphase I six to seven bivalents were observed, also univalents and occasionally trivalents.

The highest number of bivalents observed was eleven.

Only three F_2 plants could be obtained, having chromosome numbers $13u + 3r$ and $12u + 2r$ respectively.

It is assumed that allosyndesis had occurred between some of those *Ae. cylindrica* chromosomes which do not pair with *Triticum vulgare* and the chromosome of *A. triuncialis*. A certain amount of allo- or autosyndesis between other chromosomes must also have occurred.

46. Kobáltova, E. A.

633.11:575.127.2:575"791"

[A characteristic of interspecific crossing (*Tr. durum* Desf. spring wheat \times *Tr. vulgare* Will. winter wheat.)]

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930: 4: 159-76.

It is very desirable to obtain winter wheats of the *durum* type of grain. Certain *durums* were found which seemed to be semi-winter types, being much later than any of the ordinarily grown *durums*. The summer *durums* were therefore crossed with winter *vulgares*. It is believed that this is the first time such a cross has been made.

The average number of grains obtained was 72 per cent and the grains were normal when *vulgare* was chosen as the female parent, in which case the number of grains was also higher—77 per cent, than in the reciprocal cross—65 per cent.

Two *vulgare* varieties were found which in all crosses with *durum* or *polonicum* gave plants which died in the early stages of development, in both direct and reciprocal crosses. In general the success of the cross depended entirely on the *vulgare* parent, the *durums* being all of equal value.

With the two above exceptions, all F_1 plants developed normally. They were all susceptible to cold, this being evidently dominant. In habit and time of ripening however they were intermediate.

When the rather late *durum* types previously referred to were used as parents the F_1 plants were of the winter type and did not head out when spring sown. There was considerable difference in time of heading of the F_1 's from *T. durum* var. *melanopus* and *T. durum* var. *hordeiforme*, although these two themselves differed only by one to two days. Four groups were thus established for the time of heading of the F_1 's, influenced chiefly by the time of heading of the *durum* parent. The same order was retained in early as in late years.

The fertility of the F_1 plants was influenced by the time of sowing, the time of earing, but chiefly by the parental combination, some parental varieties giving comparatively high degrees of fertility in F_1 and others very low fertility.

The germination of the F_2 was rather uneven. Albino plants were observed in one year only. In severe winters only isolated plants survived, in less severe winters 20-25 per cent.

In the cross *T. durum* var. *melanopus* x *T. vulgare* var. *erythrospermum*, the number of F_2 plants which did not head when spring sown amounted to 33 per cent, whilst in the cross winter x spring *vulgare* the number was round about 10 per cent. On sowing in autumn there were 20.7 per cent of surviving plants in the first cross and 35.6 per cent in the second. Different combinations of parents gave different numbers of non-heading types, with *T. durum* var. *hordeiforme* x *T. vulgare* var. *lutescens* up to 74 per cent.

The examination of the third generation was much more difficult.

Of those F_2 plants surviving the winter, those which combined *vulgare* and *durum* characters were for the most part sterile; the *vulgare* and the *durum* types were retained. Certain *vulgare* types emerging from an earlier cross of similar forms have surpassed the hardy parent in hardiness and also give higher yields. Similarly from the present cross, some of the *durum* types proved to be as hardy as the *vulgare* parent, fully fertile, with *durum* grain of excellent quality; the morphological characters were constant, the influence of the *vulgare* parent was seen in the reduced length of awns and glume teeth.

Another highly resistant *durum* form was obtained from another cross, but this was less fertile and was still segregating for a number of characters, thus necessitating further selection. Both these forms had 28 somatic chromosomes. When spring sown neither of them headed out, behaving as true winter types.

47. **Thompson, W. P.** 633.11:575.127.2:576.3
Cytology and genetics of crosses between fourteen- and seven-chromosome species of wheat.
Genetics, 1931: 16: 309-24.

T. monococcum was crossed with *T. durum* and *T. turgidum* and the F_2 and F_3 cytologically studied. Nearly all the F_2 plants had 28 or more somatic chromosomes, only very few had one or two less. Pairing in the pollen mother cells was very variable and the numbers of univalents accordingly varied from 0-13. Trivalents occurred in some plants. Some of the plants had 42 chromosomes.

The functional F_1 gametes had about 14 or 21 chromosomes.

The heterotypic division was regular but the homotypic was very irregular. The occasional failure of wall formation after the homotypic division was assumed to account for the occurrence of the 21 chromosome gametes.

The F_3 plants examined had mostly 28 somatic chromosomes, two had less and the rest more up to 42. A considerable number of plants with individual *monococcum* characters occurred among the F_2 , suggesting that the emmer characters are chiefly in those chromosomes which pair with those of *monococcum*. Some F_2 plants possessed characters not shown by either parent.

48. **Kihara, H., and Katayama, Y.** 633.11:575.129:576.356.5
Genomanalyse bei *Triticum* und *Aegilops*. III. Zur Entstehungsweise eines neuen konstanten oktoploiden *Aegilotriticum*.
(Genom analysis in *Triticum* and *Aegilops*. III. The mode of origin of a new constant octoploid *Aegilotriticum*.)
Cytologia 1931: 2: 234-55.

In crosses of *T. dicoccoides* x *Ae. ovata* five highly sterile F_1 's were obtained which on free-flowering set five grains, giving five F_2 plants. One of these was fertile, the new octoploid *Aegilotriticum*, the other four sterile. This octoploid plant resembled the F_1 and almost certainly arose by the union of two F_1 gametes with doubled chromosome number. It remained similar in F_3 , the degree of fertility being more or less constant also; this was not so high as in Tschermak's *Aegilotriticum* f. *fertilis* No. 2. The new form is more similar to Tschermak's No. 1 and the main differences between them are tabulated; as these are considerable, it has been called f. *fertilis* No. 3.

Karyological investigations shewed that the F_1 belonged to the type with incomplete plate formation and partial equatorial division of the univalents. The behaviour of the univalents is described and it is shewn that occasionally a case may occur when all the univalents go to the equatorial plate and divide at anaphase, with the result that two gametes are formed each of

which has the complete genomes of both parents and is therefore fertile. It is regarded as improbable that the *Aegilotriticum* had resulted from a process such as this, as gametes with unreduced chromosome number would only arise by entire failure on the part of the univalents to pair, which is improbable. Moreover, such a process would occur in only a few pollen mother cells in the anther, which would be insufficient to cause the anther to dehisce.

The most probable mode of origin is thought to be by "regression" and consequent formation of restitution nuclei containing all the chromosomes, i.e. the full F_1 gamiture. This has frequently been observed and affects the majority of pollen mother cells in the anther.

The maturation division was mostly quite regular and 28 chromosomes were clearly to be distinguished at metaphase I. Similar examination was made of the sterile plants occurring in the same generation as the fertile octoploid. They are thought to have arisen by fertilization of an egg cell with increased chromosome number, formed in one of the ways discussed above, probably by regression with foreign pollen wheat or *Aegilops* species. The chromosome numbers of these four plants were 42, 46 or 48. The probable parentage based on these numbers is deduced but the number of diploids in the reduction division is in each case below expectation.

49. **Bonvicini, M.** 633.11:581.162.5
Osservazioni sulla sterilità nel grano.
(Observations on sterility in wheat.)
Ital. Agric. 1931 : 9 : p. 68.

An account of the various kinds of sterility observed in wheat, reference being made finally to a rare form appearing suddenly in a number of plants in the F_1 of a natural cross. Some plants were entirely and others partially sterile. The sterility appeared to be hereditary in nature, transmitted by the pollen.

50. **Stewart, G., and Judd, B. I.** 633.11:581.46:575.1
Inheritance of awns in a Kota x Hard Federation cross.
J. Amer. Soc. Agron. 1931 : 23 : 455-64.

The awnless wheat Hard Federation was crossed with the awned Kota and the results could be explained on the assumption of two independent factors for awns. Nine genotypes were found in F_2 , four of them true breeding in F_3 and the other five segregating. The closeness of fit was good. The results were checked in F_4 and F_5 .

51. **Miège, E.** 633.11:581.466:575
Lignées à fleurs polycarpiques dans un hybride de *Triticum vulgare* H.
(Lines with polycarpic flowers in a hybrid of *Triticum vulgare* H.)
C.R. Acad. Sci. Paris 1931 : 192 : 1482-85.

In the F_2 of a hybrid of the variety Indian Pearl x Extrême-Sud Algérien florets were observed which formed several ovaries and several fertile fruits. The distribution of such florets on the ears of two separate lines is given. Such florets contain the usual three stamens.

The grains are fertile and it is thought possible by selection to establish a line in which the majority of florets are thus polycarpic.

52. **Moskalenko, G. L.** 633.11-1.557:575.11:581.46
(Investigation of the dependence between awnedness and the elements of productivity, on hybrids of winter wheat.)
Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 227-41.

Particular emphasis is laid on the fact that the results apply only to the Ukraine and to the particular material under investigation.

For examination hybrids of winter wheat, but not pure lines, were taken, in order, amongst other reasons, to obtain the greatest possible variety of combinations. The following were regarded as "elements" of yield : weight of grain, number of grains and of stems, ratio of straw to grain, and the following grain characteristics : texture, fullness, size, "blast," the conjoint of all these judged by eye. Each of these was examined for correlation with the different degrees of awning.

The correlation between grain weight and awning in favourable years was negative and in less favourable years positive, shewing that the awnless types are more sensitive to external conditions, less adaptable. The differences however were not significant.

There was no correlation of the ratio straw : grain with awning nor of the grain texture, grain weight, the fullness of the grain, the size of grain, the amount of blast nor the eye judgment of grains.

It is concluded that there is the full possibility of obtaining awnless wheats for the steppes with as high yield as awned varieties.

53. **Bressman, E. N.** **633.11-2.451.3:576.16:575.1**

Varietal resistance, physiologic specialization, and inheritance studies in bunt of wheat.

Bull. Oregon Agric. Expt. Sta. 1931 : 281 : 44 pp.

The reaction of 10 varieties to 94 different collections of *Tilletia*, was investigated ; 4 of these were ultimately chosen as differential hosts. The bunt collections came from 22 different states and 5 foreign countries.

At least 10 forms were distinguished, 6 of *T. levis* and 4 of *T. tritici*. One of the 10 varieties used was susceptible to all forms and one (Turkey x Bearded Minnesota 48) was highly resistant, though not immune, to all. Two of these forms accounted for two thirds of the whole material and these are the ones giving reactions similar to the earlier descriptions before the existence of physiologic forms was suspected. The forms differed in their pH requirements and this forms a means of separating them. They also differ in the optimum temperature required for spore germination. The differences between forms were more marked than those between the two species.

The results are compared with those of other workers.

The varieties Albit, White Odessa, Martin, Regal and Banner Berkeley reacted identically, being resistant to many and susceptible to other forms ; Hussar, which has been said to react similarly to Martin, proved to be more resistant.

Crosses were made of Martin x the fully susceptible variety Hybrid 128 and tested with bunt forms to which Martin was resistant. The F_2 contained percentages of infected plants varying from 10 to 29.5 according to which bunt form was used. These results fail to conform to a monofactorial ratio. F_3 data suggest the interaction of two resistance factors.

Hussar was crossed with White Odessa, which is resistant to all the forms which Hussar resists and some others in addition.

When tested with forms which attacked neither parent the hybrids in F_2 and F_3 produced no bunt, whereas with forms which attacked both parents all the hybrids were fully susceptible. This indicates that these two varieties carry a similar factor for resistance to the two forms in question. Albit, a hybrid of White Odessa and Hybrid 128, is identical in reaction with its resistant parent.

The value of various varieties as parents in breeding for rust resistance is discussed. Perhaps the most hopeful at present is the highly resistant variety Turkey x Bearded Minnesota 48 which seems not to be pure yet for resistance ; it seems probable that pure line selection would lead to the establishment of lines resistant to all bunt forms yet known. In addition there seems every possibility of combining resistance to different forms by crossing such varieties as Hussar and Hohenheimer.

Highly virulent strains of the fungus seemed to be capable of being selected from the few infected ears of otherwise resistant varieties.

54. **Bressman, E. N.** **633.11-2.451.3-1.521.6:575**

The present status of breeding varieties of wheat resistant to bunt.

Zbl. Bakt. Abt. II : 1931 : 83 : 396-97.

A very brief account of the production of the smut resistant wheats Ridit, Albit and others, the later demonstration of the existence of physiologic forms and the susceptibility of all these varieties to some of the forms. One new variety has recently proved to be resistant to all ten forms.

55. Levine, M. N., and Stakman, E. C. 633.11-2.452:576.16

Black stem rust of cereals has more than 60 physiologic forms.

Yearb. U.S. Dept. Agric. 1930 : 137-40.

A brief popular account of physiological specialization, physiological form surveys and breeding resistant varieties.

56. Gassner, G., and Straib, W. 633.11-2.452 P. glumarum :576.16

Untersuchungen zur Frage der biologischen Spezialisierung des Weizengelbrostes.

(Investigations on the biological specialization of yellow rust of wheat.)

Der Züchter 1931 : 3 : 229-40.

A description of the work, some of which has previously been published, of testing large numbers of wheat varieties with seven different cultures of *Puccinia glumarum*, in which it is confirmed that several physiologic forms exist ; the failure of certain earlier authors to distinguish them is shewn to be the result of working at different temperatures. The fungus is very much more sensitive to temperature changes than other rusts and specialization may not be evident at high temperatures but is very clear at 11-15°C. It is also very sensitive to other external factors such as moisture.

Very few highly resistant wheats exist.

Attention is directed to certain discrepancies between greenhouse and field infection with the same biotype and the necessity for further study emphasized.

57. Wilhelm, P. 633.11-2.452 P. glumarum 576.16

Studien zur Spezialisierungsweise des Weizengelbrostes, *Puccinia glumarum* f. sp. *tritici*. (Schmidt) Erikss. et Henn. und zur Keimungsphysiologie seiner Uredosporen.

(Studies on the specialization of yellow rust of wheat and the physiology of germination of the uredospores.)

Arb. Biol. Reich. Land. Forstw. 1931 : 19 : 95-133.

The full account of the work described more briefly by Appel, see Plant Breeding Abstracts Vol. I, No. 334.

58. Gassner, G., and Straib, W. 633.11-2.452:581.08

Die künstliche Rostinfektion von Freilandpflanzen und ihre Bedeutung für den Pflanzenzüchter.

(Artificial rust infection of plants in the field and its importance to the practical breeder.)

Der Züchter 1931 : 3 : 240-43.

The method of spraying with a spore suspension is described, followed by the method of artificial inoculation of a susceptible variety interspersed with the plots to be tested.

59. Draghetti, A. 633.11-2.452-1.521.6:575:581.45

Osservazioni e ricerche sulla resistenza alla ruggine dell' internodo superiore nel frumento. Ricerche genetiche e morfologiche.

(Observations and researches on the resistance to rust of the upper internode of wheat. Genetical and morphological researches.)

Ann. R. Staz. Sper. Agr. Modena N.S. 1930 : 1 : 69-121.

Analyses of large numbers of F₂ progenies shewed that the leaf sheath is much less resistant to the rusts than the internode and that in both organs the resistance increases in passing upwards from the base. The degree of relationship between morphological characters and resistance varied with environmental conditions.

60. **Edgecombe, A. E.** 633.11-2.452-1.521.6:576.16
Immunological relationship of wheats resistant and susceptible to *Puccinia rubigo-vera triticea*.
Bot. Gaz. 1931 : 91 : 1-21.

Globulins of the einkorn, emmer and *vulgare* groups were used as immunizing and test antigens. The results showed a considerable relationship between the globulins of all the forms used but this relationship is not so close among the members of the *vulgare* group as it is among those of the emmer group and closer affinity may be shown with a member of the emmer group than with another *vulgare* wheat. The data indicate that serologically it is the resistant forms that are closely related, i.e., resistant and susceptible forms are each characterized by their own closely related globulins while the slightly resistant forms have globulins closely related to those of both resistant and susceptible forms.

61. **Ezekiel, W. N.** 633.11-2.452-1.521.6:581.192.6
Studies on the nature of physiologic resistance to *Puccinia graminis tritici*.
Tech. Bull. Minn. Agric. Expt. Sta. 1930 : 67 : 62 pp.

The results shewed that physiologic forms could be differentiated by the type of growth in hanging-drop cultures.

The germ tubes tended to be longer than the controls in extracts from susceptible varieties and shorter in extracts from resistant varieties. The only ones shewing an aberrant behaviour were form 39 and certain forms to which Vernal emmer is susceptible.

These results indicate that physiological resistance is caused by something in the composition of the tissues of the resistant plant which is less favourable to the growth of the fungus than that in the tissues of the susceptible plant.

62. **Ruemele, T.** 633.11:664.641.016:578.081
Ueber eine neue Methode zur Feststellung der Kleber- und Mehlgüte.
(A new method of determining gluten and flour quality.)
Das Mühlenlaborat. 1931 : No. 21 : 3-5.

The methods which have been suggested in the past are enumerated. The present method of testing the gluten consists of dissolving two equal volumes of moist gluten in two quantities of lactic acid solution, one twice the quantity of the other. The viscosities of the resulting solutions will differ less in the case of a high quality than of a low quality gluten.

63. **Pissarev, V. E.** 633.13:575 "793"
(Breeding early forms of oats.)
Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : p. 271.

Among the very large number examined no early oats were found, with a sufficiently high yield and quality of grain. Crosses are being made between members of the early group with low percentage of husk and the late group with high yield and large grains. The segregates shew the possibility of creating early forms of high yield and quality.

64. **Matsuura, H.** 633.13:575.1
Genic analysis in *Avena*. A monograph.
J. Fac. Sci. Hokkaido Imp. Univ. 1931 : Ser. V : 1 : 77-107.

Part of a revised and enlarged edition of the author's "Bibliographical Monograph on Plant Genetics 1900-1925." Literature up to 1929 is now included.

65. **Milatz, R.** 633.13:575.2
Die Anwendung der biologischen Variationsstatistik zur Unterscheidung von Getreidesorten in kritisch-experimenteller Betrachtung.
(The application of biological variation statistics to the differentiation of cereal varieties from a critical experimental viewpoint.)
Arch. Pflanzenbau 1931 : 6 : 260-98.

The following characters were studied in a number of oat varieties : length of grain, of main shoot, of main rachis, number of rachis segments, of spikelets, of grains, weight of grains, number of fertile haulms per plant.

The degree of variation in the characters differed in different varieties, only for one variety was the variation of all characters within the limit of four times the standard deviation.

Low variation was observed in grain weight, number of rachis segments and length of rachis, high variation in length of grain and of haulm, the latter being the least valuable of all the characters. The best character was the number of rachis segments.

Large variations in one character tend to be associated with high variations in the other characters too.

These variations were reckoned on the percentage of cases within the range of 4μ , they do not always agree with the variation coefficients, which are thought therefore to be a less reliable means of judging the value of a character for diagnostic purposes.

The author concludes that in respect to most of these characters the use of 4μ is too inaccurate and reliable varietal differences can only be established by taking a more rigid standard. The necessity for comparison under as nearly as possible identical conditions is emphasized. In this case characters which vary very much with environment may be used with success.

66. **Holton, C. S.** 633.13-2.451.2:575.127.2

Hybridization and segregation in the oat smuts.

Phytopathology 1931 : 21 : 835-42.

Hybridization experiments between *Ustilago avenae* and *U. levis* shewed that the two species were perfectly interfertile when opposite sexes were used. Sex factors segregated in a simple 2 : 2 ratio, segregation occurring in either the first or second division. Segregation for certain cultural characteristics also occurred, independently of segregation for sex and sometimes later than the second division.

The echinulation characteristic of the spores of the former species was dominant, as was the "loose" type of smut of this species.

The chlamydo-spores germinated but the sporidia in almost every case failed to develop. Of those which did develop some were backcrossed to *U. avenae* and intercrossed; these were successful, the smut produced in the latter case being buff instead of black; this appears to be a new type. The backcross with *U. levis* was not successful.

67. **Aggeyev, K. F.** 633.14:575.14

(Self pollination in rye.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : p. 17.

The percentage of success may vary from 0-92 in different populations and the tendency may be transmitted to the progeny. A number of families homozygous for certain recessive characters have already been established. In certain families dwarfs, deformed plants, albinos and variegated plants appeared.

There was no marked loss of vigour in I_1 or I_2 and the studies are being continued.

68. **Antropov, V. I.** 633.14:575.14

(Inbreeding in the geographical forms of rye.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 19-26.

Continued inbreeding resulted in a reduction in albinism with each successive generation.

Wild rye, contrary to expectation, was considerably more self-sterile than cultivated ryes. Samples of wild rye were obtained from various oriental habitats.

The percentage of sterility varied in different years, but the relationships between the different families remained rather constant. Varieties from the fertile zone were more sterile than varieties from without this zone.

In the third year of self-fertilization (I_3) the differences were more marked than in earlier generations.

It was possible to isolate strains of higher fertility from populations of the wild ryes but with very much less frequency or ease than in the case of the cultivated types and the fertility was frequently not retained in later generations, whereas in the cultivated types the fertility constantly rose, exceeding 90 per cent in some cases in I_4 .

The greatest degree of sterility was found in the wild forms of the Afghan-Turkestan group and the least in the cultivated rye of the northern regions.

69. **Pulman, I. A.** 633.14:575.42:664.641.016

(Breeding local winter rye.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 341-44.

The yellow-grained types were found to give a better quality flour, with higher protein, than the green type. The local rye was examined and extremely few plants proved to be uniform in grain colour. The progeny of these plants was sown separately and was subjected to repeated mass selection.

In the eleventh generation lines were isolated displaying 100 per cent constancy for the two types of grain. These yielded satisfactorily. At the same time various constant anomalous types segregated, such as variegated forms, giant, bushy forms, pink-eared forms with very large yellow transparent grains.

Under conditions of obligatory self-pollination 12 per cent of grain was produced.

The yellow-grained forms gave white flour not inferior to wheaten flour. The characteristics of the plants are enumerated.

70. **Meunissier, M. A.** 633.15(063)
633.15:575

Le premier Congrès International du Mais.

(The 1st International Maize Congress.)

Agric. Prat. Pays Chauds 1931 : N.S. No. 9 : 210-29.

Contains an account of the breeding work on maize done in France and a discussion of American work, of the production of a very early Italian variety maturing in three months, created by repeated hybridization and selection for yield and earliness since the year 1905. Reference was also made to breeding for resistance to insect attack at the new maize genetic station in the Argentine Republic, hybridization and breeding of varieties resistant to *Ustilago* in Spain, of the creation of a pure decussate type in Jugo-Slavia.

It was decided that a maize genetic station should be established in the Department Basses-Pyrénées.

71. **Khadjinov, M. I.** 633.15:575

(On the purposes of variety testing and corn breeding in U.S.S.R.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 389-402.

The article begins with a general discussion of the different maize types and their value for introduction into different parts of the U.S.S.R. The expedition to Central America disclosed a wonderful richness in types of "dent corn" and many of these are still not fully investigated. It is thought probable that selection may give valuable new forms. The other types of maize require organized breeding work to produce improved forms suitable for the U.S.S.R.

There follows a brief history of maize breeding in America, emphasizing the significance of this work for the breeding of all cross-fertilized plants.

A number of curious types mentioned in the literature are referred to as having a possible value for Russian conditions or for hybridization.

72. **Vesselovskaia, A. I.** 633.15:575 "793"

(The small number of rows in the cob as a selection character for earliness.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 73-82.

The number of rows in the cob of maize has been shewn to be a complex character closely associated with a number of other cob characters.

An examination was made, in fourteen varieties, of the following characters : length and circumference of cob, number of grains, weight of grains, weight of individual cob, weight of the dry grain of one cob, percentage of moisture at the time of harvesting, time of appearance of the stigmas.

The following characters were correlated with the number of rows but had no immediate practical importance : circumference of cob, number of grains, weight of grains and weight of undried ear.

The following characters were similarly correlated and of practical importance : time of flowering,

percentage of moisture, weight of dry grain of one cob. The length of the cob was not correlated with any of the other characters. The correlation in the first group was positive for all characters except grain weight, which gave a negative correlation. Earliness could be judged equally well by the time of flowering or the percentage of moisture in the cob at the time of harvest, these two factors being closely correlated. There was a correlation of + 0.563 between earliness and low number of rows over a period of five years. The yield increased, up to a certain point, with the number of rows. The highest yield under the conditions of the experiment was given by the sixteen-rowed types. To attain full maturity under all climatic conditions, an earlier type, the twelve-rowed, must be grown. Selection over a number of years gave a considerable increase in the percentage of types with the desired number of rows.

73. **Creighton, H. B., and McClintock, B.** 633.15:575.116.1
A correlation of cytological and genetical crossing-over in *Zea mays*.
Proc. Nat. Acad. Sci. 1931 : 17 : 492-97.

Chromosome 9 is morphologically distinguishable from the others by a knob on the end. Crossing over can therefore be detected by the presence of two knobs on one homologue and none on the other.

By crossing a normal no-knob plant with a knob interchange plant (see Plant Breeding Abstracts, Vol. I, Abst. no. 531) crossing over is indicated by the occurrence of interchange types (characterized by a ring of four chromosomes) with no-knob. The amount of such crossing over was 39 per cent and was accompanied by the expected crossing over of the genes known to be contained in that region of the chromosome.

74. **Eyster, W. H.** 633.15:575.116.1:581.162.51
Heritable characters of maize. XXXVIII Male sterile—2.
J. Hered. 1931 : 22 : 99-102.

An F_2 population contained normal and male sterile plants in the ratio 5:5 : 1 in the individuals grown from normal grains and 2 : 1 in those from shrunken grains, indicating a linkage of the character with shrunken endosperm. Such plants were selfed and backcrossed to the shrunken male sterile and the results confirmed the assumption, indicating a linkage of 22.22 per cent. The gene is therefore in Chromosome I and different from the male sterile gene previously described in Chromosome V. It is therefore named male sterile₂.

75. **Eyster, W. H.** 633.15:575.116.1:581.162.51
Heritable characters of maize. XXXIX Male sterile—3.
J. Hered. 1931 : 22 : 117-19.

A male sterile type differing clearly from male sterile₂ was observed to be linked with crinkly. It was further observed to be linked with a new character, yellow top. Both these characters are evidently therefore in chromosome VIII. The male sterile character is known as male sterile₃.

76. **Jorgenson, L. R.** 633.15:575.116.1:581.45
Brown midrib in maize and its linkage relations.
J. Amer. Soc. Agron. 1931 : 23 : 549-57.

Crosses with certain other brown midrib plants shewed the character to be identical with these. The plants were normal in chromosome number and type. The character behaved as a simple recessive. The linkage relations were examined in F_2 . There was a clear linkage with the Pr pr factor pair of the Pr - V_3 group, with crossing over percentages of 26.3-28.8.

77. **Lindstrom, E. W.** 633.15:575.116.1:581.46
Genetic tests for linkage between row number genes and certain qualitative genes in maize.

Res. Bull. Iowa Agric. Expt. Sta. 1931 : 142 : 251-88.

The method of calculating the correlations is described in detail.

A number of crosses in which the parents differed in row-number and cob colour are described. There was a tendency, sometimes not statistically significant but expressed regularly in all the crosses, for a larger number of the segregates to have the parental combination of these two characters, indicating a genetic linkage. This tendency was more marked in crosses involving one low row-numbered parent than in crosses involving another parent of the same row-number ; this suggests that their factors for low row-number are different.

Similar results were obtained, to a somewhat less degree, for row-number and Rr, one of the three factor pairs for aleurone colour. In some crosses there was similar indication of linkage with the sugary-starchy gene but other crosses gave anomalous results and further tests are thought necessary. Linkage was indicated in a similar way with the Yy factor pair for yellow endosperm.

As the four genes with which row-number appears to be linked are in separate linkage groups, it is suggested that separate genes for row-number exist in each of these groups thus giving support to the multiple factor hypothesis for the inheritance of quantitative characters.

78. **Li, H. W.** 633.15:575.116.1-181.13
Heritable characters in maize. XXXVII. Brevis.
J. Hered. 1931 : 22 : 14-16.

Brevis is characterized by a shortening of the internodes above and below the ear. There is some variation in the degree of shortening and the tillers are normal. The brevis plants are less viable than normal plants. The character proved to be linked with Pr. The order of the genes could not be exactly determined. It was independent of other linkage groups.

- 79 **McClintock, B.** 633.15:575.116.4
The order of the genes C, Sh and Wx in *Zea mays* with reference to a cytologically known point in the chromosome.
Proc. Nat. Acad. Sci. 1931 : 17 : 485-91.

By the evidence of trisomic inheritance these genes have been shewn to be associated with the smallest chromosome but one (chromosome 9). An examination of an unequal segmental interchange involving this chromosome (see Plant Breeding Abstracts Vol. I, Abst. no. 531, and Abst. no. 84 below) and the 21 chromosome individuals which sometimes result, one of the latter was seen to have two chromosomes 9 with c-sh-Wx and one interchange chromosome with C-Sh-wx. This plant gave waxy pollen in the ratio 15:1 instead of the usual 3:1. Other 21 chromosome plants contained similar interchange chromosomes involving these three genes and the evidence clearly indicates that they lie together on that part of the chromosome which the interchange involved.

Their respective distances are also deduced.

80. **Garber, R. J., and North, H. F. A.** 633.15:575.125
633.15:575.42

The relative yield of a first generation cross between two varieties of corn before and after selection.

J. Amer. Soc. Agron. 1931 : 23 : 647-51.

In previous crosses between the two varieties Clarage and Longfellow the first generation hybrid yielded more than the higher yielding parent. Subsequently the parents were selected by the ear-to-row method and the highest yielding ears of each retained. When these were crossed the first generation hybrid was exceeded by the higher yielding parent in yield.

In this case, where the two varieties evidently do not contribute different growth factors, selection is as effective as hybridization in increasing yield.

81. **Garber, R. J.** 633.15:575.14
Inbreeding with particular reference to maize.
J. Amer. Soc. Agron. 1931 : 23 : 534-48.
The general problem of inbreeding with reference to maize is briefly discussed. Inbred lines shewed considerable difference in susceptibility to smut and also in the place of infection. The methods of double crosses, synthetic crosses and backcrosses are described. The success attained by these methods in a number of places is mentioned.
82. **Lindstrom, E. W.** 633.15:575.19
Prepotency of inbred sires on commercial varieties of maize.
J. Amer. Soc. Agron. 1931 : 23 : 652-61.
A commercial variety Krug was pollinated with some of the best of the author's inbred lines and the yields of the hybrid generations compared. It was clear that each inbred line produced a characteristic progeny which differed in yield, etc.; the hybrids were all remarkably regular and all had a much lower percentage of barren stalks and more marketable ears per row. There was also a reduction in smut infection and lodging. Similar results were obtained with sweet corn. The method is recommended to commercial breeders on account of its simplicity.
83. **Lampe, L.** 633.15:581.141:575.1
A microchemical and morphological study of the developing endosperm of maize.
Bot. Gaz. 1931 : 91 : 337-76.
The developmental stages of the cells of the endosperm as well as of the endosperm as a whole were studied in the different types of corn. Carbohydrate grains of different types and in different proportions were found to correspond to different genetic types.
84. **Cooper, D. C., and Brink, R. A.** 633.15:581.162.5:576.312.36
Cytological evidence for segmental interchange between non-homologous chromosomes in maize.
Proc. Nat. Acad. Sci. Wash. 1931 : 17 : 334-38.
A study was made of semisterile-5, a line in which the sterility is connected with a chromosome ring of two pairs, one of which pairs is easily distinguishable from the other nine. This line crossed with semisterile-1 gave a ring and six chromosomes and seven bivalents, shewing that the lines had one chromosome in common. Cytological examination indicated that the ring formation had resulted from segmental interchange between non-homologous chromosomes.
85. **Jenkins, M. T., and Gerhardt, F.** 633.15-2.183-1.521.6:575.11
A gene influencing the composition of the culm in maize.
Res. Bull. Iowa Agric. Expt. Sta. 1931 : 138 : 125-51.
A character known as "lazy," because of the prostrate habit of plants possessing it, occurred in a single F_2 family of a cross of two inbred lines. The prostrate habit is the result of a weak culm. Its origin is ascribed to a mutation in one of the parental gametes. The character is a simple recessive. The breaking strength of the stems is under 50 per cent that of normal stems. The stiffness seems to have no relation to the number or distribution of the vascular bundles but the walls of nearly all the cells were thinner than those in normal plants. The plants contained a higher proportion of water. The percentage of cellulose and pentosan is always lower and decreases towards the end of the season rather than increasing. Ash constituents, water-soluble compounds and nitrogen compounds are also much less than in normal plants and the plants seem to have a lower carbon-nitrogen ratio. The osmotic concentration is lower. Microchemical examinations shewed that all parts of the plant contained much less lignin and cellulose than the normal plants, especially in the early stages, and lignin formation proceeded more slowly.

86. **McIndoe, K. G.** 633.15-2.42-1.521.6:575The inheritance of the reaction of maize to *Gibberella saubinetii*.

Phytopathology 1931: 21: 615-39.

A number of crosses were made of resistant x susceptible and resistant x intermediate inbred homozygous lines.

The method of judging resistance was tested and found to be sufficiently reliable. The necessity for uniform temperature conditions is emphasized.

No dominance of resistance was observed. The distribution of the F_3 lines in resistance classes was studied and it was evident that where the parents differed widely in reaction wider differences were evident in F_3 than when the parents differed less. Segregates transgressing the parental limits for resistance to a considerable extent appeared. In short, resistance behaved as any other quantitative character, dependent on a number of factors.

There was a significant but by no means marked correlation between vigour and resistance, indicating that the resistance might be partly dependent on growth factors.

Very little correlation could be established between resistance of the seedlings in the greenhouse and yield of the plants in the field.

87. **Huber, J. A.** 633.16:575.1:581.46

633.16:575.116.1

Vererbungsstudien an Gerstenkreuzungen. II. Zur Genetik der Gerstenähre.

(Inheritance studies in barley crosses. II. On the genetics of the ear.)

Z. Züchtung 1931: A. 16: 394-464.

Crosses between varieties of *H. distichum* and *H. deficiens* established the existence of a main factor Z for two rowedness and two secondary factors, W a factor inhibiting fertility in the lateral florets and T a factor furthering the growth of the lateral florets. Ret-ret represents the *retusum* factor for the notching and broadening of the lemma in the two rowed barleys and Mut-mut, the *muticum* factor for enlarged blunted lateral florets.

Two factors controlled the awnless condition, Ar inhibiting awns and hoods and K changing awns into hoods.

Two independent factors, Gr_1 and Gr_2 were found for barbed awns and a factor Gw for the dropping of awns. I is a factor for awn length.

Ear density is controlled by polymeric factors. C gives a dense ear and there are three factors for laxness, L1, L2 and L3.

Ear length was not genetically investigated but according to Takezaki it is controlled by two factors E and H which form two allelomorphous pairs. Ear shape may be due either to a Zeoc factor causing the three-cornered "zeocritrum" or "pyramidatum" ear in contrast to the parallel-sided shape; or to Q the factor for squareheadedness.

M, O and P are the factors for black, orange and purple glumes respectively, Sch is the factor for black pericarp besides which there is probably at least another factor causing brown and violet grains. The factor A1 causes the formation of anthocyanin in the aleurone layer, N is the factor for hulled grains, the naked grain is recessive.

The presence of long simple hairs on the basal bristle, empty glumes, lodicules and rachis is determined by a single factor A. S is a factor for the extension of the area of pubescence on the empty glumes. There are two independent factors for the broadening of the empty glumes Macr and Plat. They are definitely correlated with ear shape.

V is the factor for branched ears.

The second part of the paper is concerned with the linkage relations of the various factors and four groups are established as follows:—

I. Ar - Q - Z - W - G - V - Macr - L_1 - Q

(P for purple pericarp, C for red veins on the empty glumes, R for red pericarp (Buckley) and a second factor for awn length (v. Übisch) belong to this group but their position has not been defined.)

II. M - Sch - Gr - A

(and O for red pericarp and Br orange coloured glumes.)

III. T - S - Zeoc - C - N - Plat - Gl.

IV. K - A1.

88. **Karper, R. E., and Conner, A. B.** 633.174:575.1.061.6
Inheritance of chlorophyll characters in sorghum.
Genetics, 1931 : 16 : 291-308.

The occurrence and inheritance of albino, virescent and yellow seedlings is described ; they were simple Mendelian recessives and their similarity with those of maize is pointed out. A case of linkage between the factors for red stem and albinism with 41-34 per cent crossing over is reported. Other cases of chlorophyll deficiencies, not yet fully analysed, are mentioned, among them, one in which three factors are indicated and another in which the inheritance was maternal.

89. **Swanson, A. F., and Parker, J. H.** 633.174-2.451.3-1.531.6:575.1
Inheritance of smut resistance and juiciness of stalk in the sorghum cross
Red Amber x *feterita*.
J. Hered. 1931 : 22 : 51-56.

Inoculation of 284 F_2 heads of the cross with form one, to which *feterita* is immune, shewed in the following generation a close approximation to a 3 : 1 ratio, with susceptibility dominant. It is very desirable to combine the palatable grain with the juicy, sweet stalks of the forage sorghums and a study was also made of the inheritance of these characters. Smut infection was higher on the juicy segregates than the pithy types, in all generations from F_2 to F_8 . This is thought to be a genetical linkage rather than a physiological correlation, although there is no conclusive evidence for this.

90. **Crebert, H.** 633.3:575:581.48
Die Kornfarben der Hülsenfrüchte und ihre Unterscheidung in genetisch
bedingte und durch äussere Einflüsse hervorgerufen.
(The seed colours of legumes and their differentiation genetically and by
external influences.)
Pflanzenbau 1931 : 7 : p. 244.

Flecking and various patterns in broad beans indicate heterozygosity, a cloudy, greyish-brown colour homozygosity. Greenish colours are associated with varieties related to *Vicia faba major* ; purple is also genetically conditioned. A number of other colours are shewn to be the result of external conditions.

91. **Potressova, M. A.** 633.367:575 "793"
(Chief results of breeding small-leaved lupins (*L. angustifolius* L.) at the
Novosybhov Agricultural Experiment Station.)
Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 321-40.

The work was done with *Lupinus luteus* L. and *L. angustifolius* L.
The colour of the vegetative organs proved to be a variable character. The colour of corolla, fruit, seed coat, flower axis, hypocotyl, stem and leaves were more constant. Also earliness, yield of green matter and of seed per plant, length of plant, number of leaves on the main stem, length of internodes were seen to be clearly transmitted from generation to generation unchanged and therefore were to be regarded as hereditary characters. Similarly with the course of development of the vegetative parts of the plant, percentage composition of the stems, degree of development of lateral flowers, number of fertile branches, number of fruits per plant.

Varieties varied in earliness, retaining the same relative positions in different years in spite of variations due to conditions of moisture, manuring, etc. Late varieties varied more with differences of moisture than early varieties, the earliest varieties varied not at all. This indicates that there are physiological differences between the types.

Brief descriptions are given of a certain number of types of *angustifolius*, selected for different degrees of earliness.

Crosses of very early with higher yielding varieties shewed that earliness and height of plant were dominant or intermediate.

92. Savitzky, V. (A study of the variability in *Beta vulgaris* L.) 633.41:575.22
Bull. P.B.S.G.D. Sugar Trust, Kiev, 1930 : No. 9 : 1-32.

The variation in sugar, forage and garden beets was observed in vegetatively propagated clones to ensure genotypic uniformity as well as in varietal populations. The following characters displayed the least variability : length of life of the leaves, size of leaf lamina, number of leaves per plant. The following were the most variable : area of assimilating surface, weight of root, assimilating area per gm. of root, the ratio weight of leaves to weight of root. The variability of the percentage sugar content varied for different varieties, being least in the sugar beets. The order of variability of the characters was the same in two consecutive years ; in the second year the yield of sugar and percentage of non-saccharine materials were also seen to be very variable. The variability of the same character in different varieties was very similar, nor did differences in spacing alter the degree of variability, although the absolute value of the various characters reacted very clearly to differences of spacing. Some characters shewed a greater constancy of variability from year to year than others. As the absolute sugar content rises its variability falls.

In the experiments with vegetatively propagated clones the order of variability for the different characters was the same as in the varietal populations. It was observed that some clones shewed very much greater variability than others for the same character. This was true both for characters with high and low degrees of variability and evidently depends on the genotypic composition of the clone, some genotypes being more variable than others. Moreover clones characterized by high variability for one character also displayed high variability for a whole series of others ; some characters on the other hand were independent of the variability of others, e.g., leaf form and relative length of petiole. This is shewn by taking coefficients of correlation between the coefficient of variation for one character and that for others in the same clone. Characters whose variability was linked in this way usually shewed a similar correlation in the absolute values for different characters.

Again, the correlation between the characters in this way is greater in some clones than in others and some clones occur having a high coefficient of variation for one and a low coefficient for the other of two characters which are usually correlated.

It would seem possible, by choosing particular genotypes, to raise or lower to some extent the degree to which certain characters vary with external conditions. As for the correlations established, however, they seem to be of a purely physiological nature (indicated by the study of vegetatively propagated material) and have no genetical basis.

93. Savitsky, V. (A study of the variability of characters of *Beta vulgaris* L. in the second year of life.) 633.41:575.22
Bull. Belaya Tserkov Plant-Breed. Sta. 1930 : 5 : 69 pp.

The classification of the varieties on the characters of the flowering stalk is discussed with reference to the literature and a number of the types illustrated. The characters used are described, with indications of their variability. Races differ in so many characters that their analysis and detailed classification seems almost impossible. As the characters have no economic value, commercial varieties may often contain several different types.

For genetical and systematic use of these characters it is essential to know their individual variability and the relationship between them and the characters of the leaves and root.

All types of beet were investigated, also mangold and various annual forms but the majority of the results apply to sugar beet and the wild beet.

The variability was studied in varietal populations and was found to be much greater for some characters than others. The greatest variation was displayed by yield of seeds ($v = 59$), density of branching (number of branches per unit of stem, $v = 54$), number of stems per plant, length of branches of the first and second order. The length of the bracts was the least variable ($v = 7$). Many characters were found to vary in unison, others on the other hand varied independently of these. For instance the expression of a character in branching of the first and second order was closely related. These and other similar correlations are discussed : a close correlation was

found to exist between height of stem, length of branches, yield of seeds and weight of seeds. The angle of insertion of the branches and the density of distribution of the seeds on the branches were independent of each other and of all other characters.

In an examination of vegetatively reproduced clones the same characters shewed the maximum variation in addition to the character "central stem with side stems *v* all stems equal." The least variation was found in the angle of insertion of the branches, number of flowers in each cluster, number of clusters on the stem and on the branches of the first and second order and height of stem. These therefore are the most valuable characters from all points of view.

In the clones, correlations between the characters were again observed, whilst the angle of insertion of the branches and the distribution of the seeds were again independent; the length of the bracts also proved to be an independent character.

The coefficients of correlation were calculated for the characters in different vegetatively propagated clones in such a way that a high correlation means that a race having a high value for one character tends to have a high value also for the other. Again many characters proved to be linked in this way and the results are described. The correlations are very similar to those observed in the populations and within the clones. Taking all the results into consideration it was concluded that the following were closely mutually related: total height, length of branches and yield of seeds; the following were partially correlated amongst themselves and with the first group: number of stems and of branches, density of branches, seed weight. The following were totally independent: angle of insertion of branches, density of distribution of the flower clusters. Although there was a close parallelism between the characters in branches of the first and second orders, this was not absolute and it is thought to indicate that the two are not entirely governed by the same genetic factors. The correlation between these characters and those of the leaves and root in the first year of development proved to be very slight and inconstant.

The classification of the beets and mangolds is discussed, in general and from the point of view of the value of various ones of the nineteen characters, the study of which is here presented.

Wild specimens of *Beta maritima* and *B. vulgaris* were also examined and compared with the same characters with the biennial sugar beet as far as the difference in stage of maturity would allow and later with annual forms selected from the cultivated beets. *B. maritima* differed in many characters from all *B. maritima* forms of *B. vulgaris*. The differences for the individual characters were not large and the limits of variation for the wild and cultivated forms overlapped.

94. **Krantz, F. A., and Bailey, R. M.** 633.491:575
Recent contributions to potato breeding and related subjects.
Amer. Pot. J. 1931 : 8 : 153-58.
A general review.

95. **Klapp, E.** 633.491:575(43)
Deutsche Kartoffelzüchtung in ihren wichtigsten Schöpfungen.
(German potato breeding in its most important developments.)
Der Züchter 1931 : 3 : 162-71.

This article surveys the progress of potato breeding in Germany which has led to the production of short-stoloned plants with well-shaped tubers, resistant to wart disease. The high yield has been maintained but the starch content has diminished and there is as yet no variety resistant to *Phytophthora*.

96. **Stcherbacheva, V. D.** 633.491:575(47)
Potato breeding (report for 1925-1929).
Pub. Nossovka Agric. Expt. Sta. 1930 : Nr. 112 : 79 pp.

Intra- and interspecific hybridization followed by individual selection have been the methods used; early varieties for fallow land, high yielding varieties of medium time of ripening, and late ripening varieties with higher yield than *Deodara*, all resistant to disease, have been the desideratum.

A technique has been evolved for carrying out hybridization on a large scale.

The characters of the pollen of varieties used as male parents have been studied. Germination in culture media proved to be no sure guide to pollen effectiveness in crossing.

The seed germination was influenced by the length and conditions of storage.

Owing to irregularity of germination, etc., selection is difficult or even impossible in the first two years.

Seedlings yielded most highly in the second year and shewed a regular tendency to decline in succeeding years. Even in the six varieties developed which exceeded *Deodara* in earliness, yield and disease resistance, this tendency was observed and further investigations are to be made into it. The author thinks that this fact will make it necessary to breed new varieties of potatoes constantly from seed.

The nature of the leaf lobing proved to be one of the most constant features in inheritance and a scheme of classification involving this is proposed.

97. **Köhler, E.** 633.491-2.412.5-1.521.6

Ueber die verschiedenen Typen der Krebsresistenz und Krebsempfänglichkeit bei den Kartoffelsorten.

(The different types of resistance and susceptibility to wart disease in the potato.)

Der Züchter 1931 : 3 : 249-52.

It is shewn that resistance depends upon several distinct physiological factors. This perhaps accounts for the complicated mode of inheritance and it is suggested that a separate study of the inheritance of these separate factors might lead to results of great value.

98. **Berland, S. S.** 633.5:575

(The problems of breeding new fibre plants.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 49-66.

The object of the work is to discover substitutes for cotton, jute and Manila hemp and allied plants. The most promising of the first group is *Apocynum venetum* and an examination of this species shewed it to consist of a very large variety of widely divergent types. A new classification of the varieties is presented.

Two distinct types, differing in leaf form, etc., were found in Russia in distinct and independent regions. The different types are discussed and it is seen that certain types tend to be associated with particular climatic regions.

Forms differing in agronomic merit occur in the same variety and selection should give rapid improvement. The plants are strictly self-pollinated. They are also vegetatively reproduced, giving the possibility of establishing clones. Pure lines are being isolated by seed selection and new forms built up by hybridization. Mass selection is being used as a preliminary measure in order to get results as rapidly as possible.

The most important characters on which to base selection are : length and thickness of stem, branching, rapidity of growth, yield of fibre and uniformity in length and strength of individual fibres, the ideal type sought for being one with long, thin stems, few branches, rapidity of growth sufficient to obtain two crops per season and a high percentage of fibre uniform in length and strength.

The most promising of the second group was *Hibiscus cannabinus* imported from Persia. There was a similar variability here also and selection was made for early development of vegetative and reproductive organs, branching and a series of morphological characters of the leaf, flower and fruit.

Four race groups were established, each differing one from the other in earliness and a whole series of other characters. The characteristics of each group are described. The earliest plants in the first group ripened in 90 days, having very short stems, the latest plants in the fourth group ripened in 150 days, having very long stems on which the first flower develops quite high up the stem, a character closely associated with late ripening.

Self-fertilized material from sixteen varieties was examined for this same character and divided into four groups. None of the varieties was pure and great improvement could be effected by selection for earliness, high yield and quantity of fibre, making use of the association between most biological and agronomic characters and the height of the first flower, together with the fact that the plant is naturally self-fertilized.

In the third group was *Abutilon avicennae*, of which there also proved to be a great number of varieties differing in earliness and length of stem, which varied from 60 days and 1.5 m. to 110 days and 4m. The plant is naturally self-fertilized and forms have been selected characterized by high yield, early ripening and large fibre production and in general the most valuable of the types found in any of the three groups.

99. **Kearney, T. H.** 633.51:575

Cotton breeding to-day works with main types known in remote past.

Yearb. U.S. Dept. Agric. 1930 : 182-90.

A very brief historical account of selection in Sea Island and Egyptian, Upland and Asiatic cottons, of the methods of breeding. The necessity for isolation of the multiplication plots and for continuous roguing is emphasized.

100. **Yanushevsky, N. K.** 633.51:575:581.08(47)

(Methodics of cotton breeding, used at the Central Agricultural Experiment and Plant Breeding Station of Azerbaijan.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 451-52.

Selection is being performed on introduced varieties and hybrid populations for various component factors of yield and quality, which are enumerated. Amongst these the chief are early ripening, size of boll, disease resistance, adaptation to poor cultural conditions, quantity, length, strength and uniformity of lint, oil content of seed.

The various stages in selection are enumerated, followed by a list of the other numerous problems, including interspecific crossing and artificial induction of mutations, which the station is investigating.

101. **Harland, S. C., and Atteck, O. S.** 633.51:575.127

Intergeneric hybrids between *Gossypium* and *Thurberia*.

Amer. Nat. 1931 : 65 : 380-82.

The chromosome number of the wild Arizona cotton *Thurberia thespesioides* A. Gray is thirteen as in the Asiatic cottons. Hybrids have been obtained of it with *Gossypium stocksii*, *G. Davidsonii* and two new world Sea Island hybrids as females. Only in the latter case were mature plants obtained.

The petal spot of the *Thurberia* parent was, contrary to expectation, not dominant, suggesting that the new world parent contained two recessive genes for this character.

The hybrids were all sterile.

The above results warrant the inclusion of *Thurberia* in the genus *Gossypium* and the name *G. lanceoforme* Miers is suggested.

102. **Forbes, R. H., and Barker, H. D.** 633.51:575.42

L'amélioration du coton Haïtien par la sélection.

(The improvement of Haiti cotton by selection.)

Bull. Serv. Tech. Dept. Agric. Haiti 1930 : No. 16.

The local cotton consists largely of mixtures of four species. The selection work is carried out on *Gossypium vitifolium barbadense* which among other desirable characters possesses considerable resistance to fungous and insect attacks. In comparative tests some of these selections have surpassed all the best known foreign varieties such as Pima, Sakel, etc., in quality and yield.

The work of selection, beginning in 1927, is described. The objects are to obtain a high quality

cotton capable of taking the place of the Sea Island. The standards used for selection are enumerated, quality, percentage of fibres, yield and resistance being the main points; under quality are included length, texture, strength and colour. The origin and characters of a large number of lines are tabulated and certain outstanding ones indicated.

The first three selections have a fibre length of over 40 mm., are still segregating for texture, are strong and give on the average 30 per cent or more of fibre. The best of these has all the excellences of Sea Island; it is not quite fixed in all its characters and further selection is expected to produce an extremely valuable type. It is described and some very favourable expert reports upon it are given.

103. **Waelkens, M.** 633.51:575.42(67.5)

Inrichting en werking van een veredelingsstation der Katoonselectie in Belgisch Congo.

(Organization and work of cotton breeding station in the Belgian Congo.)

Bull. Agric. Congo Belge 1930 : 21 : 795-99.

104. **Waelkens, M.** 633.51:575.42(67.5)

Note sur les travaux de sélection dans une station de sélection cotonnière au Congo. Belge.

(Note on the work of selection in a station for the selection of cotton in the Belgian Congo.)

Bull. Agric. Congo Belge 1930 : 21 : 800-04.

The equipment and methods of five stations are briefly detailed. Up to now the methods of breeding have been mass and pedigree selection. One station has reached the third, the others the second generation. A detailed description of the ideal type in view is given.

105. **Diakonov, N. A.** 633.52:575

(A contribution to the question of breeding fibre flax according to external morphological characters.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 127-34.

A high content of fibre of the best quality, the greatest possible resistance to fungous diseases are two indispensable qualities.

An examination has been made of the correlation between the relative fibre content and the following: thickness of stem, length of inflorescence, number of flowers, the relation between length of stem up to the inflorescence and the stem diameter in the centre of its total length, tapering of the inflorescence, height and "technical length." The results apply only to the particular local varieties on which they were obtained, correlations being different for samples from different districts.

Thick-stemmed types in general contain a lower percentage of fibre than thin types, as in other fibre plants. Unbranched plants have a higher fibre content of better quality. The work of selection indicates that this is a heritable character and unbranched forms can be created by selection.

By emasculating all the flowers of a plant it was found that the upper flowers developed least seed by cross-pollination and the flowers lower down the stem, flowering later, developed more seed. Thus the uppermost flowers are valuable in breeding as they are almost certainly self-pollinated.

Another character of great importance in breeding is the number of days from germination to the end of flowering.

All the following characters are to a greater or less extent correlated with the content of long fibres: thickness at the centre of the "technical length" of the stem; the "technical length" itself; length of inflorescence; total height; number of fruits; tapering; relation of length to diameter. The last character is negatively correlated, the rest positively.

106. **Matveyev, N. D.** 633.52:575:581.08

(On the methodics of breeding fibre flax, on the first stages of the work.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : p. 223.

The judging of the elite strains and their first generation hybrids and the analysis of the fibre are among the most important processes in breeding.

Work with small quantities is much facilitated by growing in boxes in the greenhouse, determining the quantity of fibre by boiling the plants in alkali. Indirect methods of estimating the fibre—correlation methods—are not expected to give satisfactory results.

107. **Shimanovicz, S. J.** 633.52:575:581.08

(A contribution to the question of the methodics of fibre flax breeding.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 421-29.

A brief historical sketch of the breeding of flax in Russia is first given.

The author's own experiments have shown that the characters with the lowest variability are the total height and the length of stem up to the inflorescence ; other characters were very variable.

The variability coefficients were different in different years and different places but the various characters retained the same order.

The conclusion from these facts is that none of the most desirable characters examined is reliable for use as a basis for breeding.

No correlation was evident between morphological features and percentage of long fibres, total fibre strength or quality. Breeding by correlation is therefore not possible.

It is recommended that plants should be selected after phytopathological tests and tests of uniformity in height and thickness and of standing capacity, multiplied for three years and subjected to technological tests, the latter being the deciding factor in selection.

108. **Chardon, C. E.** 633.61:575

Se ha producido una nueva variedad de caña.

(A new variety of cane has been produced.)

Rev. Agric. P. Rico 1931 : 26 : 3, 31.

A valuable new hybrid with good yield and resistance to mosaic is described.

109. **Mangelsdorf, A. J.** 633.61:575(91.4)

Sugar cane breeding in the Philippines.

Hawaii. Plant. Rec. 1930 : 34 : 409-16.

The methods of crossing and selecting employed are described briefly, the parental varieties described and their constitution indicated. Many of them are hybrids of *S. spontaneum*.

In selection of the hybrids disease resistance is the most important point, also low tasseling ; other criteria are mentioned.

The numbers of the most promising seedlings so far raised are given.

110. **Bremer, G.** 633.61:576.312.35

De cytologie van het suikerriet V. Een onderzoek over de somatische chromosomenaantallen van suikerriet.

(The cytology of the sugarcane V. An investigation on the somatic chromosome numbers of the sugarcane.)

Arch. Suikerind. Ned.-Ind. 1931 : 3 : 583-607.

The counting of the large chromosome numbers found in *Saccharum* was possible only in very well and suitably developed roots ; the methods of growing these are described. By growing the roots by a new method in sand, with nutrient solution, counts as accurate as those of the

reduction division could be made. The size of the chromosome varies very much with the conditions under which the roots were grown. The cytological methods are described.

Kassoer, and some Glagah forms, never gave such good preparations as other canes.

In all, 24 different varieties were investigated and the results illustrated and tabulated. The largest and smallest numbers observed in each variety are given and those cases indicated in which the number given is regarded as particularly certain. The numbers as determined by reduction division counts are given for comparison.

In some specially favourable root tip material of P.O.J. 2878 and EK 28 the numbers 119-120 and 80 respectively could be clearly observed. Some hybrids of P.O.J. 2875 and Glagah had 166.

Varieties were observed with 60, 80, 89, 91, 97, 99, 110, 112, 116, 118, 120, 122, 127, 136, 148 and 166.

The number 80 for Demarara 1135 argues against it having any wild parentage.

The existence of Glagah types with different chromosome numbers, some with 40 and some with 112, indicates that the Glagah group ought to be sub-divided into at least two sub-groups. Other Glagah types have been found to possess 126 chromosomes.

Considerable significance is attached to the fact that *S. biflorum* also has 112 chromosomes; it is thought that it must have arisen by hybridization of forms having the same chromosome numbers as the parents of Glagah and that this is for some reason a particularly stable number. The number 118 has been ascertained for one number of *S. sinense*, shewing that it cannot be a dodecaploid.

The increased chromosome numbers previously reported in the hybrid *S. officinarum* x *S. spontaneum* were confirmed in the somatic counts. Also the cases of the "fourth ennoblement" where the chromosome numbers were and were not increased were confirmed in the somatic counts.

The somatic method has enabled accurate counts to be made for a number of varieties which were difficult on account of peculiarities of the reduction division or which rarely flowered and therefore could not be counted.

111. **Yakushkin, J. V.** 633.63:575

(Contemporary questions of sugar beet breeding.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 445-50.

The results of six years breeding for increased yield are presented.

The average percentage of increase in yield over the control for six stations was 7.87, the difference in sugar content from the control being 0.07. This increase became apparent almost entirely in the last three years, the first three years shewing very little change. The average increase in yield of sugar was over 13 per cent.

The enormously increased scale on which sugar beet breeding is being carried out in Russia is emphasized.

The increased homozygosity resulting from a certain amount of inbreeding has tended to increase the yields and even if not it affords admirable material for exploiting the phenomenon of heterosis.

In breeding for yield it was found expedient to grow the plants at very wide spacings so as to enable their individual potentialities to be fully expressed.

The non-saccharine materials have been reduced by one quarter and the injurious nitrogen compounds by one fifth.

A number of morphological features valuable for selection are mentioned.

The work is indicating that as the purity of the races is increased so their reaction to different environments becomes more specific and it is more essential to breed forms for particular districts.

112. **Becker-Dillingen, J.** 633.63:575(43)

633.416:575(43)

Abriss über die Leistungen der deutschen Zucker- und Futterrübenzüchter.

(Sketch of the work of the German sugar beet and forage beet breeder.)

Der Züchter 1931 : 3 : 172-81.

A history of the development of the sugar beet industry and of the cultivation of forage beet.

113. Yaroshevsky, P. E. 633.63:575:581.08
(The biological method of sugar beet breeding and its argumentation.)
Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 453-54.

A brief outline of the breeding methods and the points on which selection is based. Self-fertile genotypes are looked for from all parental families. In addition to this, constant selection of parent pairs and groups is practised, so as to preserve high-bred, valuable maternal lines.

114. ¹ Grinko, T. F. 633.63:575.14
(Self-pollination in the sugar beet.)
Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 111-19.

Plants varied very markedly in their reaction to self-pollination, giving yields of fruits varying from 0 to 300, the majority being between 1 and 50. The tendencies to self-pollination observed in the second were the same as in the first generation, shewing that the quality is inherited. Repeated selection for self-fertility enabled certain fertile races, transmitting their fertility from generation to generation, to be isolated. Some of these behaved autogamously even under conditions of free pollination and the fertility of these races, unlike that of partially fertile races, was independent of weather conditions.

The weight of root for such races remained constant or increased in I_1 and I_2 .
A number of recessive characters segregated out in I_2 and could thus be eliminated.

115. ¹ Archimovitsch, A. Z. 633.63:581.162.3
633.63:575.14
(Control of pollination and questions of inbreeding methods in sugar beet.)
Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 29-40.

Sugar beets were planted amongst garden beets and the percentage of hybrids determined. This varied from 70 to 95.6 per cent, with an average of 90.75 per cent.

The merits of various types of isolation are discussed.

Inbreeding is being practised with the following objects in view :—

- (1) increasing the homozygosity of the material.
- (2) the isolation of recessive characters.
- (3) the selection of self-fertile races.

For the third purpose the method of isolation of single branches is recommended.

The technique of artificial pollination is described and said to be comparatively simple. A success of 42 per cent was obtained in preliminary pollinations using this method.

116. ² Tollenaar, D., and Middelburg, H. A. 633.71:575
633.71:575.243

Grondslagen en resultaten der tegenwoordige veredeling bij de vorstenlandsche Tabak.

(Principles and results of recent tobacco breeding in the Vorstenlanden.)

Meded. Proefst. Vorstenl. Tab. Buitenz. 1930 : No. 63 : 88 pp.

The biology of the flower is briefly described and from experiments it has been shown that cross-fertilization may occasionally occur and that there is a marked tendency in some varieties towards parthenocarpy.

The variegated plants, of which a number appear every year, have been found to be the result of cytoplasmic inheritance.

¹ A fuller summary of this paper is on file at the Bureau.

² A full translation of this paper is on file at the Bureau.

Leaf-length and leaf-breadth are inherited independently and both are affected in much the same way by external conditions.

Quality is determined by Mendelian factors, probably by a large number.

For the inheritance of leaf-breadth and quality the local forms E and Kanari were crossed.

Forms constant for leaf width were obtained in F_{12} but segregation for quality still occurred.

The subject of mutations is discussed and the known mutations described. These might be dominant, recessive or intermediate, they arose as hybrids with a monofactorial inheritance except for one case of bi-factorial inheritance. Reverse mutations have been demonstrated. Spontaneous mutations were found to occur mostly during the haploid phase or shortly after. The results of many observations suggest that there exists a definite mutation period.

Flowers in all stages of development were treated with X-rays. From a total of 6,060 plants 20 mutants were obtained. These are described and their genetical behaviour analysed. Except for one dihybrid, all proved to be monohybrids.

The occurrence and behaviour of these induced mutants resembled that of spontaneous mutants. The earlier results of selection alone have not been satisfactory as the importance of quality was not sufficiently realized.

For many reasons only crossing between nearly related local races is likely to be of practical value. The F_2 shows great variability. Constancy in all characters may be expected by F_{20} when the final selection should be carried out on different estates.

By repeated backcrossing with the parent forms the chances of obtaining the desired types are considerably increased.

The possibility of further improvement by means of induced mutations is briefly discussed.

117. **Kendall, J.**

633.71:575.127.2:576.356

An aberrant *Nicotiana* with 91 chromosomes.

Amer. J. Bot. 1931 : 18 : 114-15.

A plant obtained by selfing an F_1 plant of (*N. rustica* x *N. tabacum*) x *N. tabacum* had 78 2n chromosomes. One of its selfed offspring had 36-38 chromosomes in the pollen mother cells and on selfing produced among others a plant with 91 2n chromosomes. The morphology of the plant and the cytological irregularities in the reduction division of the pollen mother cells are described.

118. **Kostoff, D.**

633.71:575.127.2:576.356.7

A fertile triple hybrid, *Nicotiana tabacum* x *Nicotiana sylvestris* x *Nicotiana*

Rusbyi. Preliminary report.

Amer. J. Bot. 1931 : 18 : 112-13.

The pollen mother cells in the F_1 of *N. tabacum* (24n) x *N. sylvestris* (12n) and of *N. tabacum* x *N. Rusbyi* (12n) have twelve bivalents and twelve univalents, those of the F_1 of *N. sylvestris* x *N. Rusbyi* have 24 univalents and the plants are self-sterile. Under certain conditions the first meiotic division was omitted in plants of the last cross and dyads instead of tetrads were formed with 24 chromosomes. Pollen from these plants was used on flowers of *N. tabacum* and vigorous fertile plants resulted. Some resembled the parents and were partially fertile with an irregular reduction division, the others were intermediate and fully fertile with regular divisions. It is assumed that the twelve *sylvestris* chromosomes combined with the twelve *tabacum* chromosomes, for which they are known to have an affinity, and the twelve *Rusbyi* chromosomes with the remaining twelve of *tabacum* and a balanced, triple hybrid is the result.

119. **Clausen, R. E.**

633.71:576.356:575.12

Inheritance in *Nicotiana tabacum*. XI. The fluted assemblage.

Amer. Nat. 1931 : 65 : 316-31.

Fluted variants are amongst the most frequently occurring in *Nicotiana tabacum* var. *purpurea*. They prove to be monosomic for the F chromosome having $23n + 1$ in place of the normal $24n$; they differ from the normal in a complex of characters.

When selfed or used as female in crosses with normals 60 per cent fluted occur in the offspring but when used as male only 2 per cent.

In the selfed progenies are frequently found Coral or Mammoth types, each of which may exist in the normal ($24n$) and fluted ($23n + 1$) condition. Coral and Mammoth are both shewn to be variations of the F chromosome, involving different portions of the chromosome.

Coral or Mammoth x normal gives three normal : one Coral, with a certain proportion of monosomic and also trisomic types. The cause of this is the frequent non-conjunction of the F chromosome in plants heterozygous for Coral (thus the F_1). A pale flowered type with completely non-functional pollen and only 10 per cent functional ovules also may occur. This apparently is an asynaptic form and does not concern the F chromosome. When crossed with normal it produced large numbers of monosomics, trisomics and more complicated variants.

Coral x Mammoth gives a normal F_1 and very little, if any, crossing over occurred in the backcross with fluted ♀; in this progeny there also appeared a certain number of normal Coral plants, evidently arising by equational non-disjunction of the fluted Coral.

Certain Carmine-coral variegates occurred in the cross fluted x Coral; these were also peculiar in having a carmine (dominant) continuous phase. The four variegates which occurred were all different phenotypically. They are thought to result from the presence and sporadic loss of a fragment of the F chromosome containing the normal allelomorph to Coral colour but not those for the other Coral characters. This indicates that Coral is not a simple factor mutation. They occasionally produce self-carmine.

By analogy with this it is suggested that Coral and Mammoth are themselves due to deficiency. The action of one chromosome irregularity in producing others in hybrid progenies is pointed out and its importance emphasized.

120. **Anderson, E., and Winton, D. de** **633.71:581.162.52**
 The genetic analysis of an unusual relationship between self-sterility and self-fertility in *Nicotiana*.
 Ann. Missouri Bot. Gdn. 1931 : 18 : 96-116.

Certain anomalies in sterility found in a single plant of *N. alata* and its progeny when crossed with *N. Langsdorfii*, are attributed to the presence of S_F , a factor belonging to the series investigated by East and, when present in the female parent, inhibiting the growth of the pollen tubes. Further selfings and backcrosses showed the presence of two recessive modifying factors which came in from *N. Langsdorfii*. Linkage was found between the sterility factor and one of the factors for pollen colour and one at least of the factors for length of corolla tube and for proportional length of style.

121. **Bachtadze, K.** **633.72:581.162.3**
 (The flowering and fruit bearing of the tea plant in Cakva.)
 Bull. Res. Inst. Tea Ind. U.S.S.R. 1931 : No. 2 : 57-88.

The biology of flowering under local conditions is described.

To solve the question of self-fertilization, plants were subjected to self-pollination by means of isolators. On account of the difficulty of isolating such large material only eight plants could be examined. The isolators used prevented the visits of insects and as pollen is hardly ever carried by wind they were not made impervious to the pollen itself.

Seven out of the eight plants gave a certain amount of seed, although the quantity was small. The majority of fruits had only one seed; the seeds were normal in size and development but often lighter in weight and sometimes empty. Many of them germinated, shewing that self-fertilization is possible in the tea plant and methods of inbreeding should hence also be possible.

122. **Cramer, J. S.** 633.73:575.42

La sélection des caféiers.
(Coffee selection.)

Bull. Écon. Indochine 1930 : 33 : 927B—940B.

A French translation of the coffee section of Fruwirth's Handbuch der Landwirtschaftlichen Pflanzenzüchtung.

123. **Arkhangelsky, S. A.** 633.79:575.42

(Preliminary communication on the work with hops, conducted at the Plant Breeding Station of the Agricultural Academy of Timiriazev.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : p 27.

Morphological and chemical examinations have shewn that the varieties are genetically impure and indicated a clear possibility of improving them by selection.

The only successful method is to employ criteria based on qualities of direct practical bearing (resin content) in judging varieties, as opposed to the indirect methods recommended in the past.

124. **Bressman, E. N.** 633.79-1.547.1:578.082

Developing new varieties of hops.

Science 1931 : 74 : 202-03.

In order to hasten breeding operations seeds were chilled for ten days below freezing point, rubbed on coarse emery paper and grown with light from 500-watt electric bulbs from 5 to 12 p.m. Flowers were in this way obtained in March from seeds sown in the previous October.

125. ¹ **Plachek, E. M.** 633.854.78:575.14

(The processes of form originating in the sunflower under the influence of hybridization and inbreeding.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 289-301.

Inbreeding afforded a means of isolating constant forms differing to an extent never previously observed.

In reciprocal crosses between the edible sunflower *H. macrospermus* and the ornamental *H. cucumerifolius*, resistant to *Orobanche cumana*, the F_1 in each case almost entirely resembled the maternal parent, whichever this was. No clear ratios occurred in F_2 , the maternal characters again predominating. Very reduced fertility was also observed and the cross was difficult to effect. *H. macrospermus* is therefore definitely regarded as a distinct species.

The seeds of the hybrids often surpassed the parent in size, reaching 2 mm. and more.

A certain, very small, number of the edible types with large seeds which emerged were fertile. It was very rare that these were resistant to *Orobanche*.

Inbreeding led to the isolation of a number of hitherto unknown types, one of which had white, very abundant pollen and was very fruitful. These were thought to be recessive mutants. The other pure types isolated by inbreeding afford a valuable basis for the work of hybridization.

126. **Plachek, E. M.** 633.854.78-2.5:575

(Problems of sunflower breeding.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 283-88.

By means of repeated individual selection varieties of the oleiferous sunflower resistant to *Homeosoma nebullella* and *Orobanche cumana* have been evolved; similarly an early variety maturing in 72-74 days.

¹ A fuller summary of this paper is on file at the Bureau.

Great variation in-oil content was observed and the behaviour of different families in successive years shewed the character to be inherited.

Inbreeding and selection enabled constant, homozygous strains with high yield and resistant to the above parasites to be established. Various of these pure lines are being intercrossed with the object of creating varieties of commercial value and resistant to both forms of *Orobanche cumana*.

Forms of the sunflower differ also in reaction to *Puccinia Helianthi*, some being fully immune, and similar methods are being applied to the creation of commercial rust-resistant varieties.

By crossing the edible sunflower with *H. merifolius* resistance to *Orobanche* has been introduced and the seeds have frequently become more thin-husked.

Efforts are being made to breed autogamous forms.

127. **Zhdanov, L. A.** 633.854.78-2.5:576.16

(A contribution to the question of the immunity of the sunflower to *Orobanche*.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 135-36.

Orobanche cumana, parasitizing the sunflower, consists of two races, the second of which contains forms slightly differing in morphological characters.

The second race attacks varieties immune to the first race and is exceedingly widely spread in Russia.

Certain amongst the local forms and varieties of sunflower are less damaged than others. These forms were picked out and tested. Resistant forms were thus found both amongst the cultivated and wild sunflowers and some forms were fully immune.

128. **Godding, R.** 633.855.34:575.42

Observation de la production de palmiers sélectionnés à Mongana (Equateur)

(Observations of the yield of selected palms at Mongana)

Bull. Agric. Congo Belge 1930 : 21 : 1263-66.

The palms all originated from var. *tenera* mother plants by free pollination and only 30 per cent of them were of this type. Observations were made on 200 individual palms, 89 of which were of the *tenera* and 111 of the ordinary (*dura*) type. The first year's observations indicate that it is possible by selection to obtain palms with fruits giving a mean of 32.4 per cent of oil ; that the *tenera* produced more fruits than the *dura* types ; that the mean yield of oil per palm was raised to 3.680 kg. for the former and 2.044 kg. for the latter.

Certain palms gave much higher yields ; the ten best palms produced an average of 7.252 kg. of oil each, 22.571 kg. of fruit with an average oil content of 32.12 per cent. Of the palms of outstanding oil content eight palms attained an average of 43.5 per cent.

By continued observations of this nature the best palms will be selected and intercrossed.

129. 633.855.34-1.547.1

Note sur la germination des graines de palmier à huile.

(Note on the germination of oil palm seeds.)

Agric. Prat. Pays Chauds 1931 : N.S. No. 11 : p. 394.

A brief description of the method described by A.V.R.O.S. in a recent publication, whereby germination can be accelerated.

130. **Lvov, N. A.** 633.88:575

(Breeding of medicinal plants. Peppermint, Black Mallow.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : p. 217.

Medicinal plants consist of an extremely diverse mixture of varieties and even species. There are great possibilities in the field of selecting pure lines of constant quality and the creation of new varieties by hybridization. This work is in progress.

131. **Hall, C. J. J. van** 633.912:575

Review of the most important publications on rubber culture issued in 1930. II

Int. Rev. Agric. Rome 1931 : 22 : 258-69.

Contains a section on selection, a review of work by Tengwall and Heusser.

132. **Jacob, J. C. s'** 633.912:575.12

Proeven over kunstmatige kruis- en zelfbestuiving bij *Hevea brasiliensis*.

(Experiments on artificial cross and self-pollination of *Hevea brasiliensis*.)

Arch. Rubbere. Ned.-Ind. 1931 : 15 : 261-88.

The results of cross- and self-pollination vary very much in different years, evidently as a result of variation in weather conditions, mildew and the like.

The numbers of successful crosses and of fruits produced are given for a large number of different combinations. The best combination gave a success of 31.8 per cent, the worst only 0.6 per cent. The results shew that the choice of pollen parent makes a great difference to the success of a cross. With some females the differences between the pollen parents are much greater than with other females.

The influence of the female parent is still greater, all differences from 1.6 to 17 per cent being observed. Various possible causes for these differences are suggested.

The results of reciprocal crosses were often very different, some combinations shewing greater differences than others; some varieties have particularly good, others particularly poor pollen. The total successes from cross-pollination were 7.3 and from self-pollination 6.1 per cent. Self-pollination should therefore frequently occur in nature and cases where it has been observed are mentioned.

In comparison of female flowers of different ages, some combinations gave the best results when unopened flowers were used, others with already opened flowers, whilst in some combinations there was no difference and in any case the differences were not sufficiently great to warrant a restriction of operations to a particular period of flowering. A certain number of successful pollinations (0.7 per cent) was made on the fourth day after opening. No success was obtained later than the fourth day.

The differences due to age of the male flowers was still less and although the success with pollen from open flowers was a little greater than from unopened the difference was not such as to make it advisable to discontinue to use unopened flowers.

In the tree used for similar experiments with self-pollination, the age of both male and female flowers had a very marked influence on the success of self-pollination.

The greatest success was obtained by pollinating flowers which had been open for about 18 hours, after this the results fell off rapidly. Reasonable success was obtained earlier than this and the author recommends pollinating during the early hours of the day as well as at midday.

Comparisons of the two methods of pollination under dry weather conditions shewed that the muslin bag method was more successful than the cotton wool plug method, but the differences were quite small (2 per cent) and probably not such as to outweigh the greater rapidity of the latter method.

Tests of the number of successes resulting from self-pollination in flowers isolated by muslin bags placed over the whole inflorescence gave 10.1 and 15.1 per cent. This is better than the

results of artificial self-pollination evidently owing to the fact that pollination occurs when both male and female flowers are at the most suitable stage.

Better results were obtained from sound than from less sound trees.

The time of ripening is seen to be influenced chiefly by the female parent but to a certain extent also by the male.

The average percentage germination for all selfed seed was 78 and for all crossed seed 84. There seemed to be no correlation between the percentage germination and the percentage success of the cross.

The velocity with which seed germinated was different for different combinations, which shews the inadvisability of selecting the seeds germinating first in a mixed population.

133. **Nikolayev, V. F.** 633.913:576.16

[The singling out of botanical forms and selection in the rubber plant guayule (*Parthenium argentatum* Gray)].

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 243-50.

The Black Sea region has a winter temperature too low for the tropical rubber plants but guayule plants from sub-tropical Mexico succeeded and proved to be highly polymorphic. As a preliminary to selection for rubber content a full botanical examination was made, with particular reference to the relation between this and morphological features.

Forms differed in the amount of branching and in the characters of the various parts of the flower. The material collected in the expedition to Mexico was divided into eight sub-groups or varieties which are described.

A high degree of constancy was displayed by the various forms as well as the individual characters and selection for rubber content will be carried out when the plants reach a suitable age.

134. **Grüner, M. N.** 634.1/2:575.11

(Breeding varieties of fruit trees.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 121-25.

Differences to-day within varieties are thought to result partly from the more frequent propagation by seed in the past, partly from the occurrence of mutation without detection and the selection, conscious or unconscious, of desirable bud mutants for further propagation.

It is pointed out that the random methods of hybridization in the past have necessitated the production of excessively large families to give the chance of the desired combination appearing and that had the genetic behaviour of the characters been known the work would have been much simplified and the possibilities of success increased.

The author has reason to believe that self-fertilization by insect visits from one flower to another of the same tree will be more successful than artificial self-pollination and experiments are being designed to test this.

Stress is laid on the necessity for co-operative investigations on the part of all stations of not only the seedlings retained but of those rejected, so as to elucidate little by little the genetic behaviour and constitution of the parental forms.

135. **Rudloff, C. F.** 634.1/7:575(43)

Einiges über die Obstzüchtung in Deutschland.

(Fruit breeding in Germany.)

Der Züchter 1931 : 3 : 197-204.

A summary of the past and present position.

136. **Shamel, A. D., Pomeroy, C. S., and Harmon, F. N.** 634.13:575.252

Bud variation in Bartlett pear trees.

J. Hered. 1931 : 22 : 81-89.

Amongst the bud variants observed were types with ridged fruits, known as "corrugated"; with slightly rough skins, known as "russet" and thought to be more desirable commercially than the original; with fruits in which a section of the skin is of the "russet" type; with ribbed fruits; with fruits with shortened vertical axis and increased diameter, "flattened"; with abnormally large fruits; with fruits of abnormal shape.

In all other characters the variants seem to be identical with the normal. When top-worked on to normal trees all these are transmitted and remain constant.

137. **Branscheidt, P.** 634.23:581.162.5

Weitere Mitteilungen über die Befruchtungsverhältnisse beim Obst, insbesondere bei Kirschen.

(Further data on the fertility relationships in fruit, cherries in particular.)

Die Gartenbauwissenschaft 1931 : 4 : 387-427.

The first half is taken up with a discussion of criticisms of a previous paper in which a method of testing fertility by germination tests was described.

Germination tests were made with pollen alone, pollen and the style of the same variety or flower and pollen and the style of another variety. The results of these experiments are to be published later. Large numbers of flowers were also emasculated and subjected to self- and cross-pollination.

The position of the greatest abundance of fruit on the untouched part of the trees indicated that pollination was normally effected by transference of pollen from one tree to the adjacent one by the wind.

A certain number of varieties were fully self-sterile, three late varieties gave 5 per cent to 33.3 per cent set on artificial self-pollination. No variety set fruit when merely enclosed to prevent cross-pollination.

Certain crosses were also unproductive, two intersterility groups being established. The remaining varieties were interfertile in varying degrees and the best pollinators for various varieties are indicated.

138. **Toxopeus, H. J.** 634.3:575.12

Ervaringen en resultaten van het in 1928, 1929 en 1930 uitgevoerde kruisingswerk in citrus.

(Experiences and results in citrus crossing.)

Korte Meded. Algem. Proefst Landb. Buitenz. 1931 : No. 9 : 13 pp.

A large number of different species of *Citrus* have been intercrossed; a table is given indicating which of these set seed and which did not. Out of 100 different combinations 67 gave hybrids.

The biology of flowering is discussed and the species divided into two types, viz., those which bear only hermaphrodite flowers and those which bear also pure male. The relative proportions of these vary according to variety and also within one variety, so that selection might be practised for this character. It is seen that the tendency is to be self-pollinated but a number of cases of cross-fertilization are mentioned. Flowering can often be hastened by watering.

The technique of hybridization is described, including the method and efficiency of preserving pollen.

Species differ in their value as male parents and the results of reciprocal crosses are often very different; the length and nature of the style plays a part in this effect. The number of crosses necessary to produce a particular number of progenies is given for certain varieties.

139. **Trautwein Dupertuis, C. B.** 634.61:581.162.3
 La pollinisation artificielle du cocotier.
 (Artificial pollination of the coconut.)
 Agr. Prat. Pays Chauds 1931 : 2 : 85-90.

A type with thick, upright trunk, a good crown of large leaves, good fruits in large numbers is the ideal.

The flowering of the coconut palm is described. At certain times of the year there seems to be a tendency to produce a larger number of female flowers. Palms producing female flowers on all branches of the spadix are very vigorous and give very good pollen.

The male flower lasts for different times in different varieties. Pollen has been preserved for more than a fortnight.

The main pollinating agents are insects and self-pollination is very rare. The method of artificial pollination is very briefly described. Very good nuts have been produced by these methods.

140. 634.62:575.183
 B.P.I. men discover a secret of pollination. Knowledge of effect of pollen on tissues of the mother plant aids date growers.
 Off. Rec. 1931 : 10 : 225-26.

Pollen from certain male date palms is said to influence the size of the fruit produced and the time of ripening, pollen from some trees giving early and others late ripening. This phenomenon may prove a valuable tool in the hands of commercial growers.

141. **Johnston, S.** 634.711.2:581.163
 The value of plant and tip selection in the propagation of the black raspberry.
 Quart. Bull. Mich. Agric. Expt. Sta. 1931 : 13 : 195-99.

The weight of the tip is relatively unimportant in determining the yield of the plant produced from it, as was also the yield of the parent plant.

142. **Petrov, A. V.** 634.75:575.12
 (An essay to study the first hybrid generation of the strawberry, method of selection and description of the hybrid forms.)
 Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 251-59.

Obligatory self-fertilization induced by isolation resulted in the formation of perfectly normal fruits, with seeds which germinated normally. Many of the plants produced however were ill-developed and produced very small flowers and fruits.

The hybrids between two varieties differing in many morphological features were examined. A complicated segregation occurred in the first generation. Large fruits occurred in the ratio 3 : 1 as also sweet flavour and dark red colour. Most characters were seen to be heterozygous in the parents.

There was no correlation between flesh colour and form of fruit, between flesh colour and presence or absence of stamens.

The yield per hybrid plant varied from 3.0 to 267.0 gm. with an average of 83.7 ± 2.9 . The average weight per fruit varied from 2.2 to 10.5 gm., with an average of 5.54 ± 0.09 ; the average parental weights were 4.07 and 4.7 respectively.

The content of acid, sugar and aromatic material was estimated and the quality of the fruit flavour estimated by tasting. The quality of the hybrid was intermediate between that of the parents.

The flowering of the hybrid plants extended over almost three weeks, the flowering period of the parents being 26 and 24-5 days respectively. A certain number of hybrids began to flower

before the earlier parent and 9.4 per cent after the later parent. The behaviour with respect to fruiting and ripening was similar, the majority being intermediate between the parents. Types with shortened and with lengthened time required for ripening of fruit occurred.

With regard to cold resistance the parental forms were of an intermediate nature and the hybrids were similar, with a certain amount of variation.

The parents differed somewhat in disease resistance and the hybrids could be divided into three groups, attacked much, intermediate and little. The first group was more resistant than the more resistant parent; this was the smallest group.

No correlation could be established between flavour and morphological characters by which the selection for flavour might be simplified. There was no correlation either between yield and size of fruit.

It is concluded that to combine the good qualities of both parents should not be difficult, but to create new types corresponding to an ideal standard would be much more difficult. In particular the possibility of creating varieties whose fruit matures more quickly and which come into bearing sooner without flowering earlier, seems to have been established, since some of the hybrids shewed this character.

The hybrid families were selected on the basis of time of maturity (early, medium and late varieties being desired), yield, flavour, disease and cold resistance and transportability.

Various families were promising in these respects and the best ones are being crossed amongst themselves.

143. **Schiemann, E.** 634.75:575.127.2

Geschlechts- und Artkreuzungsfragen bei *Fragaria*.

(Genus and species crosses in *Fragaria*.)

Bot. Abhandlg. No. 18.

A full account of the work referred to in Plant Breeding Abstracts Vol. I, Abs. no. 240.

144. **Ravat, J. F.** 634.835.094

Du rôle néfaste des mauvais hybrides pour la qualité des vins.

(The disastrous effect of poor hybrids on the quality of wines.)

Rev. Vitic. Paris 1931 : 38 : 58-61, 72-75.

A discussion of direct producers, in which a number of resistant hybrids which give wine of the highest excellence is described.

145. **Rouart.** 634.835.094

Les hybrides producteurs directs.

(Direct producer hybrids.)

Prog. Agric. Vitic. 1930 : 94 : 572-75.

Plantations of hybrids are mentioned which gave good results when the ordinary methods completely failed. Many of these hybrids which gave wine of good quality are indicated.

146. **Neyrac, M.** 634.836-1.541.1:575

Contribution à l'étude des porte-greffes.

(Contribution to the study of stocks for grafting.)

Prog. Agric. Vitic. 1930 : 93 : 206-10, 232-36, 254-60.

The value of a number of different species and hybrids as stocks for different types of soil is examined.

147. **Moog, H.** 634.836.093
 Ueber Aramon x Riparia 143B M.G.
 (On Aramon x Riparia 143B M.G.)
 Die Gartenbauwissenschaft 1931 : 4 : 497-512.

Several varieties are cultivated under this name in Germany. The hybrid is described as a very valuable stock. A large number of references to it in the literature are cited. The various types differ in their resistance to *Phylloxera*. Different results have sometimes been caused by the uncertainty of the names of the varieties. An attempt is made to clear up this question. A description is given whereby the two types "bearing" and "not-bearing" can be distinguished in the early growth stages.

148. **Börner.** 634.836.72.094:575
 Züchtung reblausfester Reben.
 (Breeding *Phylloxera*-resistant grapes.)
 Deuts. Weinbau 9 : Nr. 46 : 523-26.

The author describes some experiments in which he crossed the high quality European grapes with the American ones. The results indicate that it will be possible to create direct producers resistant to both races of *Phylloxera*.

149. **La Reille, C. de** 634.836.75.094
 La résistance des hybrides au mildiou et la qualité de leurs vins.
 (The resistance of hybrids to mildew and the quality of their wine.)
 Prog. Agric. Vitic. 1931 : 95 : 133-35.

A number of the hybrids tested gave wine of equal quality to that of *vinifera*, others a greater quantity of alcohol per hectare, and their cultivation is recommended.

150. **Paponov, N. V.** 634.851:575.22
 (Materials for breeding grapes on the southern coast of the Crimea.)
 J. Gov. Bot. Gdn. Nikita 1931 : 16 : No. 1., 51 pp.

The most reliable size of plot for testing was determined by experiment. The choice ultimately was given to plots of 115.0 cm.

In tests of the purity of the varieties the best were shewn to contain from 0.8 to 12.04 per cent of mixtures of other varieties, not counting undesirable variants of the same variety. A number of variants (clones) have been separated from the individual varieties in this way, displaying clear morphological and biological differences. Various of these clones are described and illustrated for the varieties Mourvèdre (four variants), Clairette Blanche (two), Kakour Blanche (two). Similarly variants have been observed in other varieties; e.g., hereditary fruit colour variants in the Muscat, etc.

Variation was observed in the number of buds left on pruning—this varies with the variety and from vineyard to vineyard; similarly with the number of annual shoots, number of fruitful and unfruitful branches—the fourth bud was shewn to produce a much larger percentage of fruitful branches than the second and third, and the first much less still. The flower characters vary within the varieties and even in one plant or one inflorescence, all stages being observed in certain plants between normal hermaphrodite to hermaphrodite with imperfectly developed pistil. In some varieties purely female clones are found. Various anomalies were also observed. Self-fertilization experiments were performed with three hermaphrodite forms and with forms with functional female flowers. The average percentage of successes in the former was 28.0

and 22.4 respectively in two successive years but varied greatly in different varieties. The variety giving the highest percentage of successes was Traminer with 54.1. Very small percentage of successes was sometimes obtained also with the latter type of plants.

The number of clusters varies with the treatment, etc., but is nearly constant for some varieties. Of the total plants examined 9.1 per cent had no fruit, 19.7 per cent one or two bunches, 50 per cent three to seven and 20.9 per cent more than seven. The yield was therefore variable; this varied from 520 to 3,630 gm. per plant. The size and form of the bunches is also very variable, as also the size and weight of the fruits, their sugar and acid content.

A number of seed characters characteristic for the varieties is indicated. These vary to a certain extent within the variety, plant and cluster just as the above characters. The yield proved rather constant for each variety.

The correlation between yield and a number of characters, together with a number of other correlations, was studied and the results are given. The following are possibly associated with yield: quantity of leaves, size of plant, length of pruning and number of shoots. Sugar content is negatively correlated with yield but some varieties combined both to a certain extent.

151. **Tubeuf, C. F. v.** 634.972.3:581.162.32
 Unerwünschte Bastardbildung.
 (Undesired hybrids.)
 Z. PflKrankh. 1931 : 41 : 386-87.

Impure forms in a seedling family of *Populus tremula* were seen to be the result of out-pollination with *P. alba*. The wood of such hybrids is much less fine-grained and so less valuable.

152. **Kappert, H.** 635.1/6:575(43)
 Erfolge und Arbeitsziele in der deutschen Gemüsezüchtung.
 (Achievements and aims in German vegetable breeding.)
 Der Züchter 1931 : 3 : 204-09.

The results and future requirements, such as earliness, lateness, uniformity, winterhardiness and disease resistance for trade purposes of peas, beans, cabbages and salad plants.

153. **Popova, E. M.** 635.34:575.42
 (Selection varieties of the cabbage.)

Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed. 1930 : 4 : 303-20.

On selecting for shape of head it was found possible very quickly to increase the proportion of round types, the flat types gradually disappearing. The compactness was increased in a similar way.

The extent to which the stalk rises inside the head was a more or less constant varietal character and was evidently hereditary, similarly with the yield. All varieties contained more or less early individuals, some varieties varied more than others.

A brief description of a number of varieties is given, earliness being the most important criterion of the value of a variety.

154. **Bremer, A. H.** 635.52-1.547.4:575.11
 Einfluss der Tageslänge auf die Wachstumsphasen des Salats. Genetische Untersuchungen I.
 (Different length of day for lettuce varieties. Genetical investigations.)
 Die Gartenbauwissenschaft 1931 : 4 : 469-83.

Reduced length of day enabled good heads to be obtained with spring lettuce in summer and shooting was considerably delayed. On the other hand with summer lettuce this was not the case, the heading and shooting remained almost unchanged under conditions of reduced length of day.

A cross was made between these two types, which flowered together when grown with a twelve hour day. Many crosses were made, of which only few were successful.

The F_1 was grown also with a twelve hour day; two particularly fine plants were obtained, which gave 4,000 good seeds. When the F_2 was grown in the field three quarters of the plants went immediately to seed, one quarter headed. Similar ratios were evident for green and yellow leaves. The ratios were confirmed in F_3 .

Grown with reduced lengths of day the yellow-leaved plants in the F_2 tended to die off. Nevertheless the following four groups were distinguished :—

- (1) Green plants with small leaves and firm heads.
- (2) Green and greenish-yellow plants with rather firm heads and large leaves.
- (3) Green plants with a loose rosette of leaves.
- (4) Very weak yellow plants and other yellow plants which attempted to form heads.

The plants were difficult to classify and many transitional forms appeared.

The results show that the dependence of shooting on the length of day is a simple dominant, inherited independently of colour of leaves.

Varieties possessing this dominant character are useless for cultivation in summer in northern climates unless the light is regulated. A new classification of varieties based on this character is presented.

155. **Whitaker, T. W.**

635.61/3:577.81

Sex ratio and sex expression in the cultivated cucurbits.

Amer. J. Bot. 1931 : 18 : 359-66.

49 varieties comprising eight species and four genera were studied. Sex expression was a specific character with some qualitative variation among the varieties. The number of staminate flowers increased gradually during the flowering period to a maximum and then fell off sharply as did that of the pistillate flowers to a lesser degree in the varieties studied.

The data supports Corren's theory for monoecious plants in which a gene or set of genes determines the sequence of sex determination and which may be modified by alterations in the external conditions.

156. **Erith, A. G.**

635.651:575.11

The inheritance of colour, size and form of seeds and of flower colour in *Vicia Faba* L.

Genetica 1930 : 12 : 477-510.

This is a study up to the F_2 of crosses between ten varieties of *Vicia Faba* L. The characters studied are flower colour, height, seed coat colour, hilum colour, size (weight) and form (shape) of seed. Many of the characters shew a monofactorial inheritance. For the determination of form the 'index of form,' or length plus breadth/maximum thickness, is used. Both size and form are determined by several cumulative factors. The results are compared with those of earlier investigators.

157. **Currence, T. M.**

635.652:575.11:581.47

Inheritance studies in *Phaseolus vulgaris*.

Tech. Bull. Minn. Agric. Expt. Sta. 1930 : 68 : 28 pp.

The stringiness of the common types is due to a heavy sclerenchymatous development in the cap of the vascular bundle. This tissue is not lignified in the stringless types.

The F_1 — F_3 generations of crosses between these two types in some cases indicated monofactorial inheritance with ratios of 1 : 2 : 1. In one cross an inhibiting factor to the factor for stringless appeared to be present. Some earlier results of Emerson are also explained on this basis.

In other crosses two dominant complementary factors appear to govern the formation of strings. Moreover the same stringless variety when crossed with two different stringy varieties gave different results, indicating the existence of two distinct stringy types.

Crosses were made between plants with and without fibre in the side wall of the pod. The character was evidently complex and the F_3 results could not be fitted in with a simple scheme of inheritance. They were different in different crosses.

The width of pods (flat v. round pods) also seemed to be dependent on a number of factors. There was a significant correlation between width of pod and of fibre content and this is evidently so strong a linkage that no fibrous round-podded type is known.

In a cross between yellow and silver podded plants a pure white type appeared in F_2 in addition to the parental types. The white type combines the colourless inner parenchyma of the yellow with the colourless outer parenchyma of the silver. Clear dihybrid ratios were observed and confirmed in F_3 . Monofactorial ratios were obtained when the white plants were crossed with silver and yellow plants and when silver plants were crossed with green.

158. Currence, T. M.

635.652:575.11.061.6:581.47

A new pod color in snap beans.

J. Hered. 1931 : 22 : 21-23.

In a cross between yellow podded and silver podded plants, white podded plants segregated in F_2 in numbers conforming with the hypothesis that each of the parents differed from the normal in having the recessive allelomorph of one of the factors for green colour. The further breeding of the F_2 types confirmed this view.

159. Haan, H. de

635.656:575.11

Contributions to the genetics of *Pisum*.

Genetica 1930 : 12 : 321-439.

The paper describes work on *Pisum sativum* L. ampl. Asch. and Gr. and deals with the analysis of three groups of characters, flower colour, including patched and dotted flowers, stem length and yellow variegation (albomaculatus).

1. Flower colour factors. The work is a continuation of that of the Tedins and he accepts as starting point the trifactorial basis proposed by these authors and Wellensiek, namely, A a fundamental factor for flower colour giving alone light purple and A_r and B as intensifiers. The following colours are investigated :—

- (a) apple blossom. This colour with apple rose and apple violet is recessive for the factor A_p , which influences the colour of the flower only and does not, like the earlier determined factors, influence that of the leaf axil.
- (b) pinkish white. In the recessive condition a factor A_m inhibits the formation of anthocyanin. It produces a dull rose leaf axil and is the first example in the pea of a differential colour effect caused by a single factor.

A, thus, becomes a ground factor without which all forms are white while all $a_m a_m$ forms are pinkish-white even though the intensifying factors be present. The probable date^s of the mutational origin of the forms considered are traced out from historical records.

2. Patched and dotted flowers. The material is derived from a single plant with purple patched flowers observed by Dr. Mansholt in 1923. After a wide series of experiments which include selfing and crossing with the types dealt with in the former section, he finds that purple dotted is inherited from both parents but purple patched only from the female and he concludes that the original purple patched was a mutant in two directions, a factorial mutation of A to A_2 and the passage of the protoplasm into a labile state. He discusses at considerable length the bearing of his results on Chittenden's vegetative segregation and Eyster's genomeric theory.

3. Stem length. The factor L_e has long been recognized as the determinant of height. To this he adds two more factors, L_a and L_b , which act as inhibitors. Dwarf, thus contains one or both of these factors ; absence of both, whether the factor L_e be present or not, produces a 'slender' form which attains a height of 4m. He identifies, but does not work out in full detail, two further factors, L_c and L_d , also having an inhibiting effect on height, thus giving a multiple group of five factors. The factor L_b appears to be absolutely linked with the factor W which develops a slight waxy coating. The 'slender' type shows a reduced fertility and affords an example of parthenocarpy.

4. Yellow variegation. Two cases of yellow, and one of white, variegation of lateral branches were observed. The latter yielded no seed. Yellow variegation is inherited only through the female parent ; it corresponds with the status 'albomaculatus' of other plants.

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